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NATIONAL DAM SAFETY PROGRAM. ROOSEVELT PARK DAM (NJ00378) RAHWA--ETC(U)
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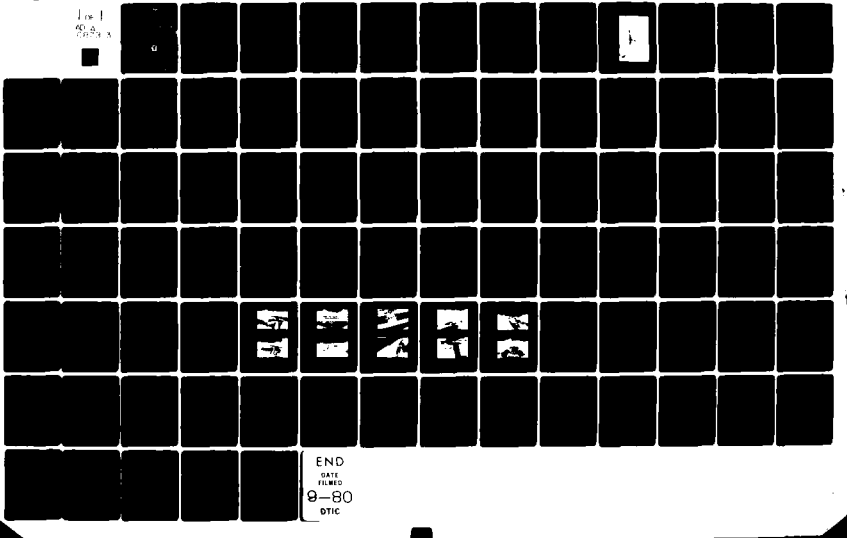

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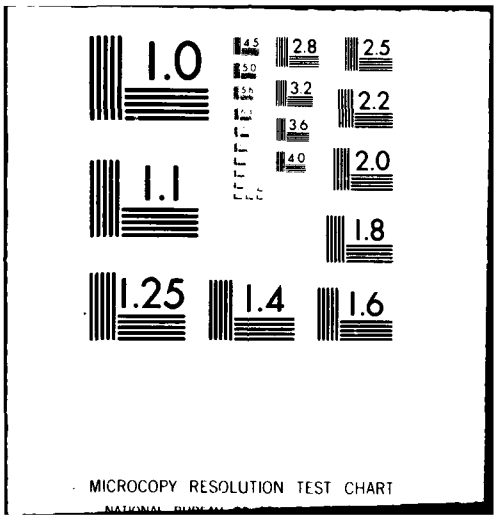
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MIDDLESEX COUNTY
NEW JERSEY

ROOSEVELT PARK DAM

NJ 00378

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

JANUARY 1980

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Safety
Structural Analysis
Visual Inspection
National Dam Safety Program
Roosevelt Park Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

24 JUL 1980

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Roosevelt Park Dam in Middlesex County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Roosevelt Park Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to nine percent of the 100-year flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from date of approval of this report, the following remedial actions should be initiated:

(1) A qualified professional consultant should be engaged to prepare a detailed design for embankment improvements, including any necessary filling and regrading, and the embankment should be renovated accordingly.

(2) The concrete walls, spillway approach channel, outlet pipe and spillway structure should be thoroughly inspected and renovated.

(3) The gate lift stem and the lifting mechanism should be thoroughly inspected and renovated if necessary. Also, the lock securing the lifting mechanism should be repaired or replaced.

(4) All trees on the embankment should be removed.

c. The owner should develop an emergency action plan which outlines actions to be taken by the operator to minimize the downstream effects of an emergency, together with an effective warning system, within six months from the date of approval of this report.

d. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Patton of the Fifteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Board, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

ROOSEVELT PARK DAM (NJ00378)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 9 November 1979 by Storch Engineers under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Roosevelt Park Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to nine percent of the 100-year flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from date of approval of this report, the following remedial actions should be initiated:

(1) A qualified professional consultant should be engaged to prepare a detailed design for embankment improvements, including any necessary filling and regrading, and the embankment should be renovated accordingly.

(2) The concrete walls, spillway approach channel, outlet pipe and spillway structure should be thoroughly inspected and renovated.

(3) The gate lift stem and the lifting mechanism should be thoroughly inspected and renovated if necessary. Also, the lock securing the lifting mechanism should be repaired or replaced.

(4) All trees on the embankment should be removed.

c. The owner should develop an emergency action plan which outlines actions to be taken by the operator to minimize the downstream effects of an emergency, together with an effective warning system, within six months from the date of approval of this report.

d. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPROVED: _____
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: _____

(9) Final rept., (10) Richard J. McDermott (11) Jan 80 (12) 87

(6) PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Roosevelt Park Dam, (NJ00378)
State Located: New Jersey
County Located: Middlesex
Drainage Basin: Rahway River Basin,
Stream: South Branch Rahway River, Middlesex County, New Jersey.
Date of Inspection: November 9, 1979

Phase I Inspection Rept.

(15) DACW61-79-C-0011

Assessment of General Conditions of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, the dam is assessed as being in fair overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillways are not sufficient to pass the designated spillway design flood (100-year storm) without an overtopping of the dam. The spillways are capable of passing approximately 8 percent of the spillway design flood. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses relating to the spillway capacity. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

The embankment is eroded in several locations and exhibits evidence of previous washouts adjacent ot each side of the spillway structure. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to prepare a

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detailed design for embankment improvements, including any necessary filling and regrading, and the embankment should be renovated accordingly.

It is further recommended that the following remedial measures be undertaken by the owner in the near future.

1) The concrete walls, spillway approach channel, outlet pipe and spillway structure should be thoroughly inspected and renovated.

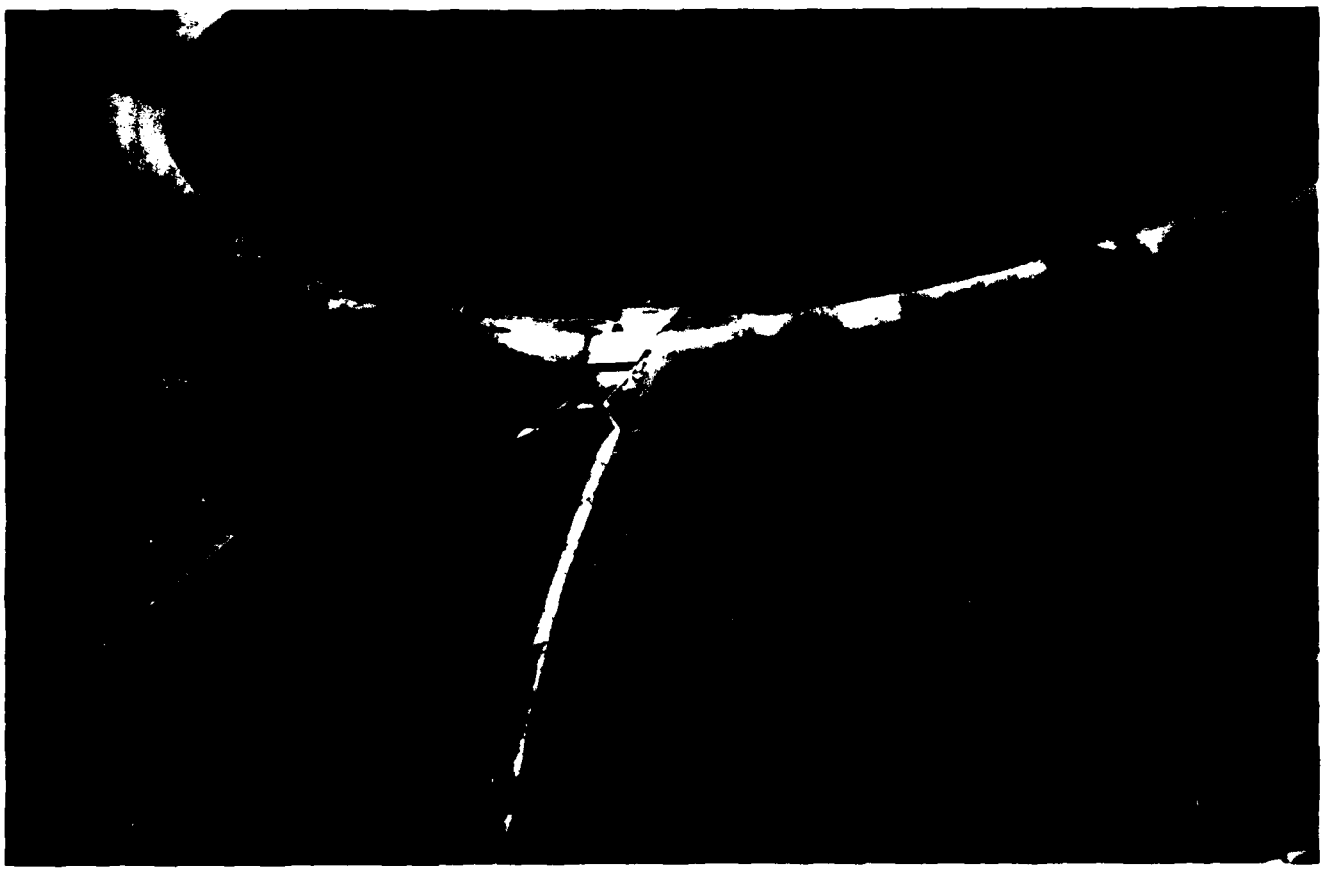
2) The gate lift stem should be repaired and the lifting mechanism should be thoroughly inspected and renovated if necessary. Also, the lock securing the lifting mechanism should be repaired or replaced.

3) All trees on the embankment should be removed.

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.



OVERVIEW - ROOSEVELT PARK DAM

29 NOVEMBER 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 30214. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

ROOSEVELT PARK DAM, I.D. 00378

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Roosevelt Park Dam was made on November 9, 1979. The purpose of the inspection was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description

Roosevelt Park Dam is an earthfill dam with a central concrete structure serving as spillway, auxiliary spillway and outlet works. The spillway consists of two concrete weirs extending along portions of the upstream side of the dam and discharging through two openings in the central spillway structure. The weirs are fitted with timber stoplogs which can be used to regulate the lake level within a vertical range of 1 foot.

The auxiliary spillway consists of a combination cast iron grate and concrete chute located on top of the central spillway structure. A gated opening in the upstream wall of the spillway structure serves as outlet works. The spillway structure discharges through a 48-inch reinforced concrete pipe to a cobblestone lined downstream channel.

The crest of the dam is generally level and uniform in width and is paved with a gravel foot path. The upstream face of the dam consists of a concrete wall for a portion of its length and a grassed slope for the remainder. The downstream face of the dam is generally grassed with bushes and trees located along the majority of its length.

The elevation of the spillway crest is 58.3, national geodetic vertical datum (N.G.V.D.) while that of the auxiliary spillway is 58.8. The crest of dam is at elevation 59.8 and the downstream channel bed elevation is 52.1. The overall length of the dam is 638 feet and its height is 7.7 feet.

b. Location

Roosevelt Park Dam is located in the Town of Edison, Middlesex County, New Jersey. It impounds a recreational lake located in a small public park adjacent to Roosevelt Hospital. Principal access to the dam is through the park which is entered from Parsonage Road. Discharge from the spillway of the dam flows into the South Branch of Rahway River.

c. Size and Hazard Classification

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams," published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	Impoundment	
	Storage (Ac-ft)	Height (Ft.)
Small	<1000 and ≥ 50	<40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (no permanent structures for human habitation	Minimal (Undeveloped to to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures	Appreciable (Notable agriculture, industry or structures)
High	More than a small number	Excessive (Extensive community, industry or agriculture)

The following data relating to size and downstream hazard for Roosevelt Park Dam have been obtained for this Phase I assessment:

Storage 65 acre-feet

Height 7.7 feet

Potential Loss of Life:

A public road bridge (Parsonage Road) is located 300 feet downstream from the dam. Four dwellings are located about 1000 feet downstream and lie approximately 10 feet above the stream bed. Six dwellings are located about 2000 feet downstream and lie approximately 5 feet above the stream bed. Failure of the dam could possibly cause loss of life.

Potential Economical Loss:

In addition to the Parsonage Road bridge, a railroad bridge is located 700 feet downstream and another road bridge 1700 feet downstream from the dam. Damage could be sustained by these bridges as a result of dam failure.

Therefore, Roosevelt Park Dam is classified as "Small" size and "Significant" hazard potential.

d. Ownership

Roosevelt Park Dam is owned by the County of Middlesex and is operated by the Middlesex County Parks Department, P. O. Box 661, New Brunswick, New Jersey.

e. Purpose of Dam

The purpose of the dam is the impoundment of a lake used for recreation.

f. Design and Construction History

Roosevelt Park Dam reportedly was constructed by the WPA in 1935.

g. Normal Operational Procedures

The dam and appurtenances are operated and maintained by the Middlesex County Parks Department. Repairs are made on an "as needed" basis.

Reportedly, the outlet works gate is generally opened during heavy rainstorms. The gate is also used to drain the lake for maintenance purposes. The lake was last drawn down in or around 1964.

1.3 Pertinent Data

a. Drainage Area	1.2 square miles
b. Discharge at Damsite	
Maximum flood at damsite	Unknown
Outlet works at pool elevation	92 c.f.s.
Spillway capacity at top of dam	113 c.f.s.
c. Elevation (N.G.V.D.)	
Top of Dam	59.8
Maximum pool-design surcharge	60.6
Spillway crest	58.3
Auxiliary Spillway Crest	58.8
Stream bed at toe of dam	52.1
Maximum tailwater	55.4 (Estimated)

d. Reservoir

Length of maximum pool	1400 feet (Estimated)
Length of recreation pool	1300 feet (Scaled)

e. Storage (Acre-feet)

Recreation pool	26 acre-feet
Design surcharge	94 acre-feet
Top of dam	65 acre-feet

f. Reservoir Surface (acres)

Top of dam	35 acres (Estimated)
Maximum Pool - design surcharge	39 acres (Estimated)
Recreation pool	11 acres

g. Dam

Type	Earthfill
Length	638 feet
Height	7.7 feet
Sideslopes - Upstream	Varies: Vertical, and 2 horiz. to 1 vert.
- Downstream	10 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Diversion and Regulating Tunnel — N.A.

i. Spillway

Type	Weir and Orifice
Length of weir	273 feet
Opening of orifice in each side of spillway structure	1.4 feet
Crest elevation	58.3
Gates	N.A.
Approach channel	Concrete channel leading to orifice in each side of central spillway structure.
Discharge channel	48-inch RCP

j. Auxiliary Spillway

Type	Drop Inlet and Chute
Length of Weir	11 feet
Crest elevation	58.8
Gates	N.A.
Approach channel	N.A.
Discharge channel	Drop Inlet: 48-inch RCP Chute: Chute serves as discharge channel

k. Regulating Outlet

3' X 3' lift gate

SECTION 2: ENGINEERING DATA

2.1 Design

No plans nor calculations pertaining to the original construction of the dam could be obtained. Reportedly, drawings relating to the repair in 1970 are available in the files of the Middlesex County Parks Department.

2.2 Construction

No data nor reports pertaining to the construction of the dam are available.

2.3 Operation

No data nor reports pertaining to the operations of the dam are available.

2.4 Evaluation

a. Availability

Available engineering data is limited to that which is on file at the Middlesex County Parks Department. The file contains drawings relating to the repair in 1970.

b. Adequacy

Available engineering data pertaining to Roosevelt Park Dam is not adequate to be of significant assistance to the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

The validity of engineering data cannot be assessed due to the absence of data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Roosevelt Park Dam were performed on November 9, 1979 by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.

b. Dam

The crest of the dam is generally level and uniform in width and serves as a foot path for pedestrians using the park. The downstream face of the dam is grassed with some trees and bushes. On the downstream side of the dam near the spillway significant erosion in the form of gullies was noted. It appears that the erosion has been caused by frequent overtopping of the dam. On each side of the spillway structure, evidence of previous embankment washouts was observed. The washed out areas were filled with large pieces of concrete and asphalt as well as with soil.

The concrete wall comprising the upstream face of a portion of the dam and also serving as spillway crest was observed to be in generally satisfactory condition. This wall also forms one side of the spillway approach channel. The concrete wall comprising the other side of the spillway approach channel was leaning in the upstream direction in several locations and steel anchors were observed to be in place at some of the construction joints. In one location, the wall was supported by a timber brace.

c. Appurtenant Structures

The concrete spillway structure shows some spalling on the upper slab at the upstream end. The concrete on the chute appears to be more recent than on other parts of the spillway. Spalling was observed on the inside surface of the spillway structure on the upstream wall near the gate opening. Also, slight leakage was observed at the bolts used to secure the gate. The outlet works operating mechanism was not operated at the time of inspection and the stem was observed to be bent. The 48-inch reinforced concrete pipe appeared to be in satisfactory condition with some spalling along the invert.

d. Reservoir Area

The impoundment of the dam is 1300 feet long with a width varying from 400 to 700 feet. It is surrounded by a grassed park and its shore slopes are generally moderate. The only structure on the lake is a pedestrian timber bridge near the upstream end. Soundings in the lake indicated that sediment in the lake is concentrated at the upstream end.

e. Downstream Channel

The spillway discharges into the South Branch of Rahway River which is quite well defined in the vicinity of the dam. Between the dam and Parsonage Road the river appears to be a manmade channel with well formed sides paved with cobbel stones for half of the length. Obstructions to flood stage flow are caused by three downstream bridges within 1700 feet of the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in the Roosevelt Park Dam impoundment is regulated by discharge over the spillway weirs and through the openings normally fitted with stoplogs. The outlet works of the dam can be used to drain the lake or to augment the discharge capacity of the spillway. Reportedly, the gate is opened during heavy storms by County Parks maintenance personnel.

The most recent drawdown of the lake occurred 10 years ago when the outlet gate was reportedly replaced. It was reported that 5 days was required to drain the lake completely.

4.2 Maintenance of the Dam

Reportedly, maintenance is performed only on an "as needed" basis. The most recent maintenance reportedly was performed during 1979 when the gravel path on the dam crest was completely renovated to correct erosion caused by recent overtopping.

4.3 Maintenance of Operating Facilities

The outlet works for the dam is maintained on an "as needed" basis. It was reportedly serviced 10 years ago when the gate was replaced.

4.4. Description of Warning System

Reportedly, no warning system is currently in use for the dam.

4.5 Evaluation of Operational Adequacy

The operation of the dam has not been successful to the extent that the dam reportedly has been overtopped nearly every year.

Maintenance is inadequate and maintenance documentation is poor. Areas of maintenance that have not been adequately performed are:

1) Gate lift stem bent and the lock on the chain has the key broken in it.
2) Spalls and deterioration on both the outside and inside of the spillway structure.
3) Washout sections adjacent to the central spillway structure not properly filled.
4) Erosion on the embankment not properly filled.
5) Trees and bushes on the embankment not removed.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The intensity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff intensity, called the spillway design flood (SDF) is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. The SDF for Roosevelt Dam falls in a range of 100-year frequency to 1/2 PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The SDF peak computed for Roosevelt Dam is 1394 c.f.s. This value is derived from the 100-year flood hydrograph computed by the use of the HEC-1-DB Flood Hydrograph Computer Program using the SCS Method. Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of an orifice formula appropriate for the configuration of the spillway structure. The combined spillway and auxiliary spillway discharge with lake level equal to the top of the dam was computed to be 113 c.f.s. The SDF was routed through the dam by use of the HEC-1-DB computer program using the

modified Puls Method. In routing the SDF, it was found that the dam crest would be overtopped by a depth of 0.8 feet. Accordingly, the subject spillways are assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

Reportedly, the dam has been overtopped approximately once each year and the embankment adjacent to the spillway structure has been partially washed out. No damage to downstream structures was reported at the time of the overtoppings and washout.

c. Visual Observation

Erosion and evidence of a washout of the embankment were observed at the time of inspection.

d. Overtopping Potential

As indicated in paragraph 5.1.a. a storm of magnitude equal to the SDF would cause overtopping of the dam to a height of 0.8 foot over the crest of the dam. The spillways are capable of passing approximately 8 percent of the SDF with lake level equal to the top of dam.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the time of inspection to be outwardly structurally sound with no evidence of cracks or distress. No seepage was observed near the dam during inspection. The displacement or leaning of the concrete wall forming one side of the spillway approach channel does not appear to be an indication of distress in the embankment.

b. Generalized Soils Description

The generalized soils description of the dam site consists of alluvial soil composed of stratified materials deposited by streams overlying glacial terminal moraine. The terminal moraine consists of silt, sandy silt and silty sand with varying amounts of gravel and small amounts of clay deposited at the outer edge of the ice sheet during the Wisconsin stage of continental glaciation. The glacial terminal moraine overlies soft red shale bedrock known as the Brunswick Formation.

c. Design and Construction Data

The analysis of structural stability and construction data for the embankment are not available.

d. Operating Records

No operating records are available for the dam. The water level of Roosevelt Park Lake is not monitored.

e. Post-Construction Changes

Reportedly, the spillway structure was reconstructed and the outlet gate was replaced around 1970.

f. Seismic Stability

Roosevelt Park is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dam" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. Roosevelt Park Dam appeared to be stable under static loading conditions at the time of inspection.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillways of Roosevelt Park Dam are assessed as being inadequate. The spillways are not able to pass the SDF without an overtopping of the dam.

The embankment appeared, at the time of inspection, to be generally outwardly stable, with previous washouts on both sides of the spillway structure filled by dumped soil, concrete and asphalt.

The structural integrity of the dam is considered adequate based on visual inspection. No reported nor written evidence was found that would contradict that assessment.

b. Adequacy of Information

Information sources for this report include 1) field inspections, 2) USGS quadrangle, 3) aerial photograph from Middlesex County, 4) consultation with maintenance personnel of Roosevelt Park. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Construction and as-built drawings.
2. Description of fill material for embankment.
3. Design computations and reports.
4. Maintenance documentation.
5. Soils report for the site.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Roosevelt Park Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillways are considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to the spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

In addition, it is recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to prepare a detailed design for embankment

improvements, including any necessary filling and regrading, and the embankment should be renovated accordingly.

It is further recommended that the following remedial measures be undertaken by the owner in the near future.

1) The concrete walls, spillway approach channel, outlet pipe and spillway structure should be thoroughly inspected and renovated.

2) The gate lift stem should be repaired and the lifting mechanism should be thoroughly inspected and renovated if necessary. Also the lock securing the lifting mechanism should be repaired or replaced.

3) All trees on the embankment should be removed.

b. Maintenance

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

PLATES

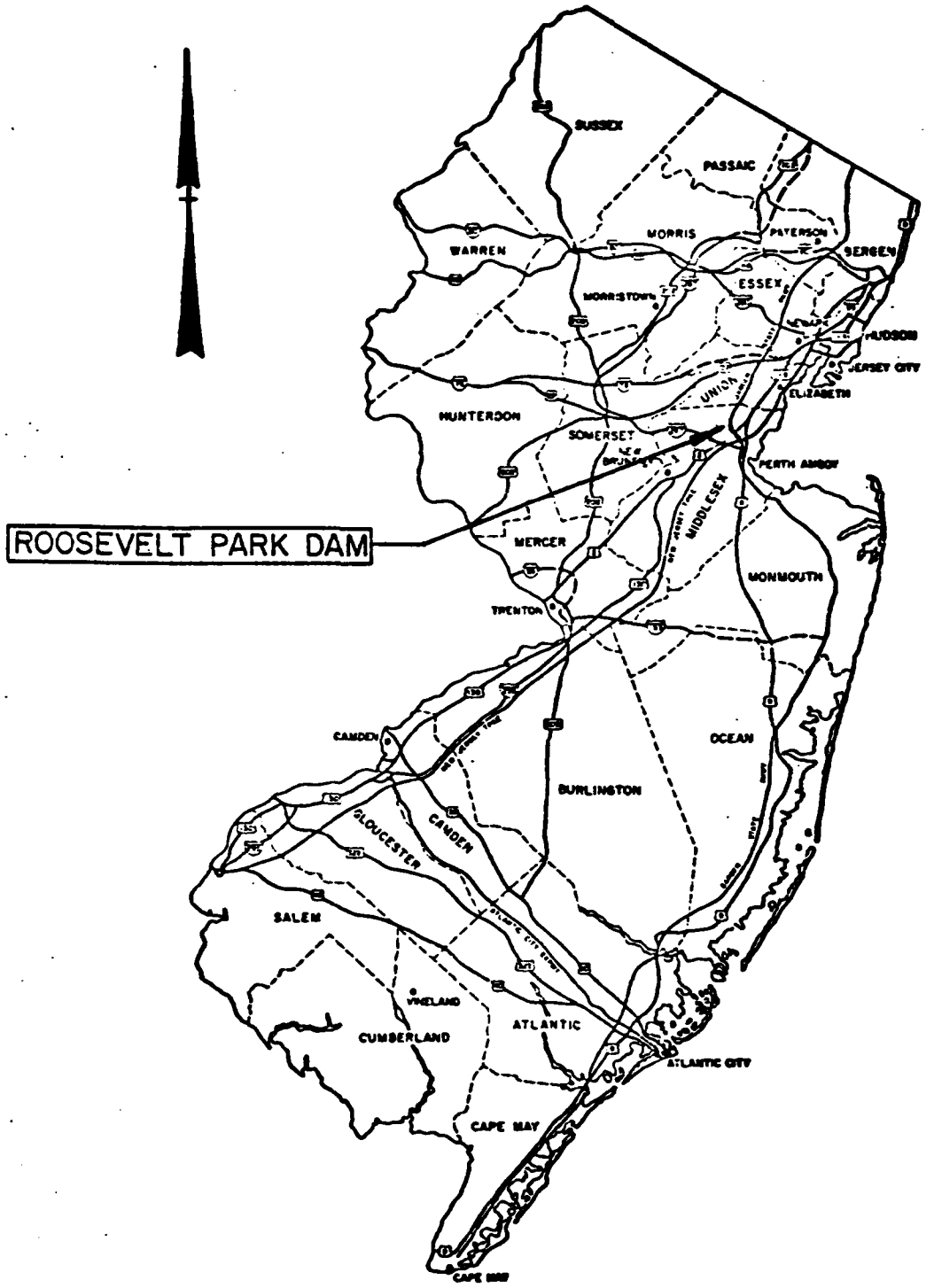

PLATE 1

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

KEY MAP

ROOSEVELT PARK DAM

I.D. N.J. 00378	SCALE: NONE
	DATE: NOV., 1979

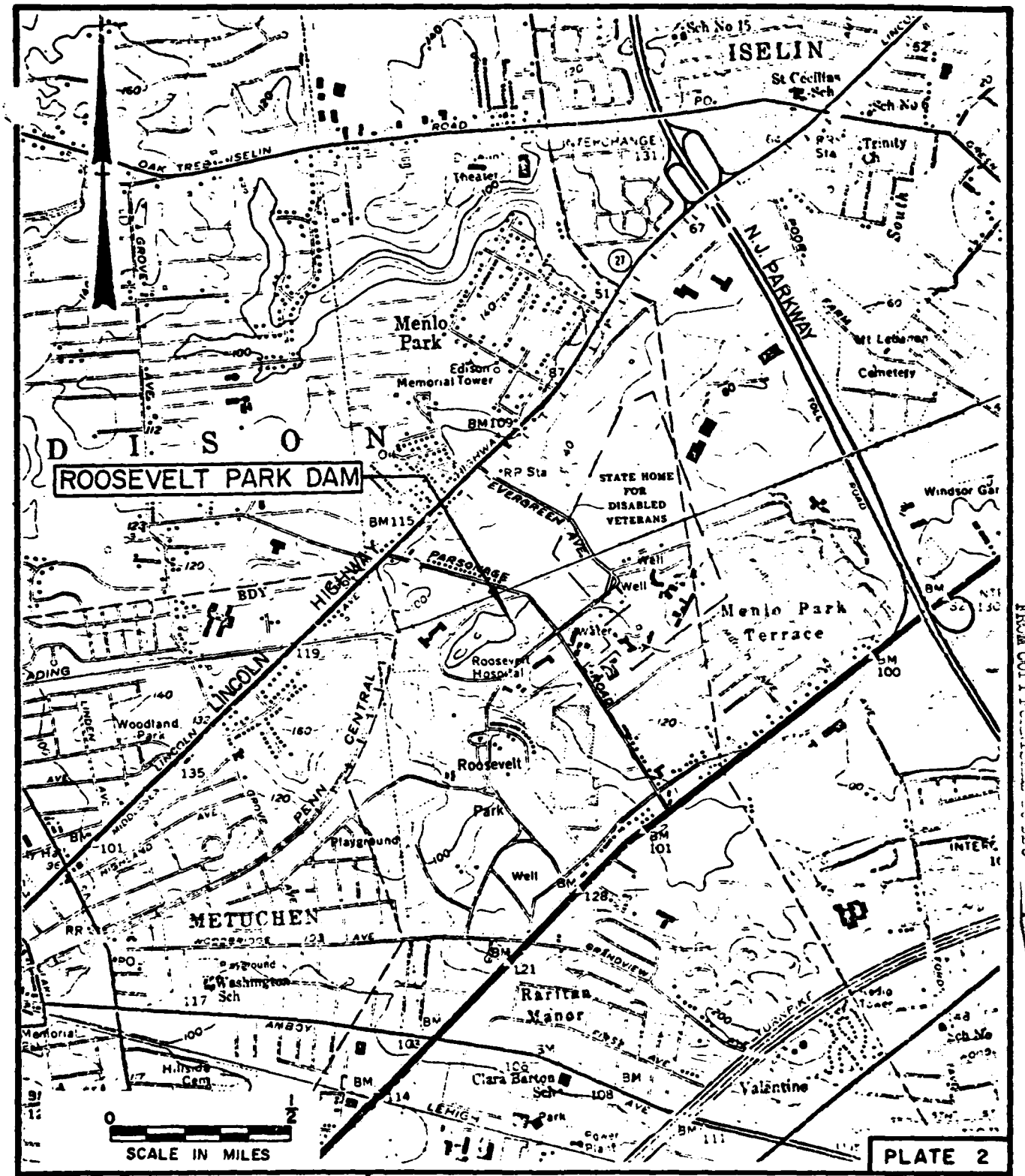

PLATE 2

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STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

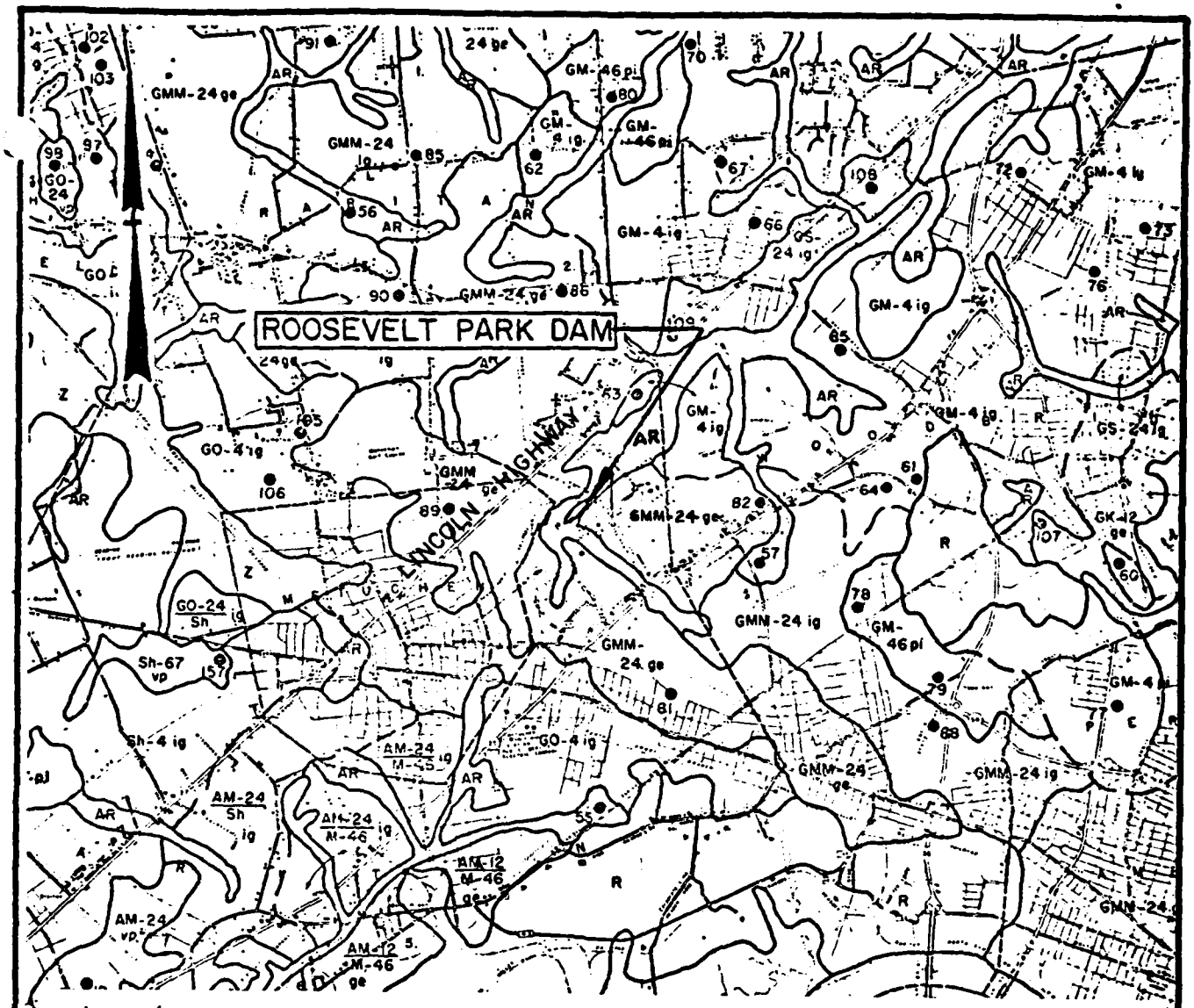
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

ROOSEVELT PARK DAM

I.D. N.J. 00378	SCALE: AS SHOWN
	DATE: NOV., 1979



Legend

AR — Recent alluvium composed of stratified materials deposited by streams.

GMM-24 — Glacial Terminal moraine. Silt, sandy silt and silty sand with varying amounts of gravel and small amounts of clay deposited at the outer edge of the ice sheet during the Wisconsin stage of continental glaciation.

NOTE: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 10, Middlesex County, and Geologic Map of New Jersey prepared by Lewis and Kummel.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

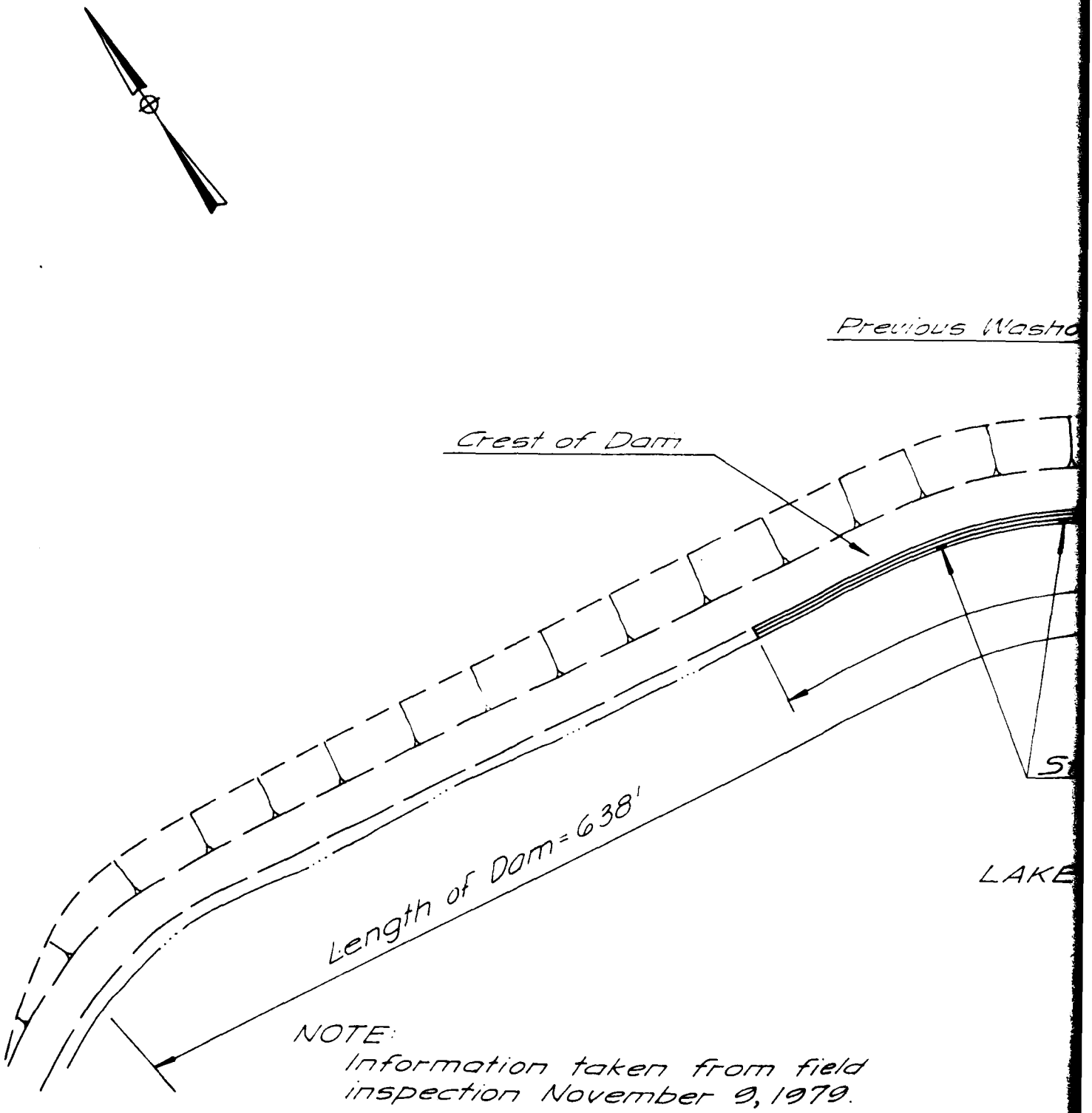
SOIL MAP

ROOSEVELT PARK DAM

I.D. NJ00378

SCALE: NONE

DATE: NOV., 1979



NOTE:
Information taken from field inspection November 9, 1979.

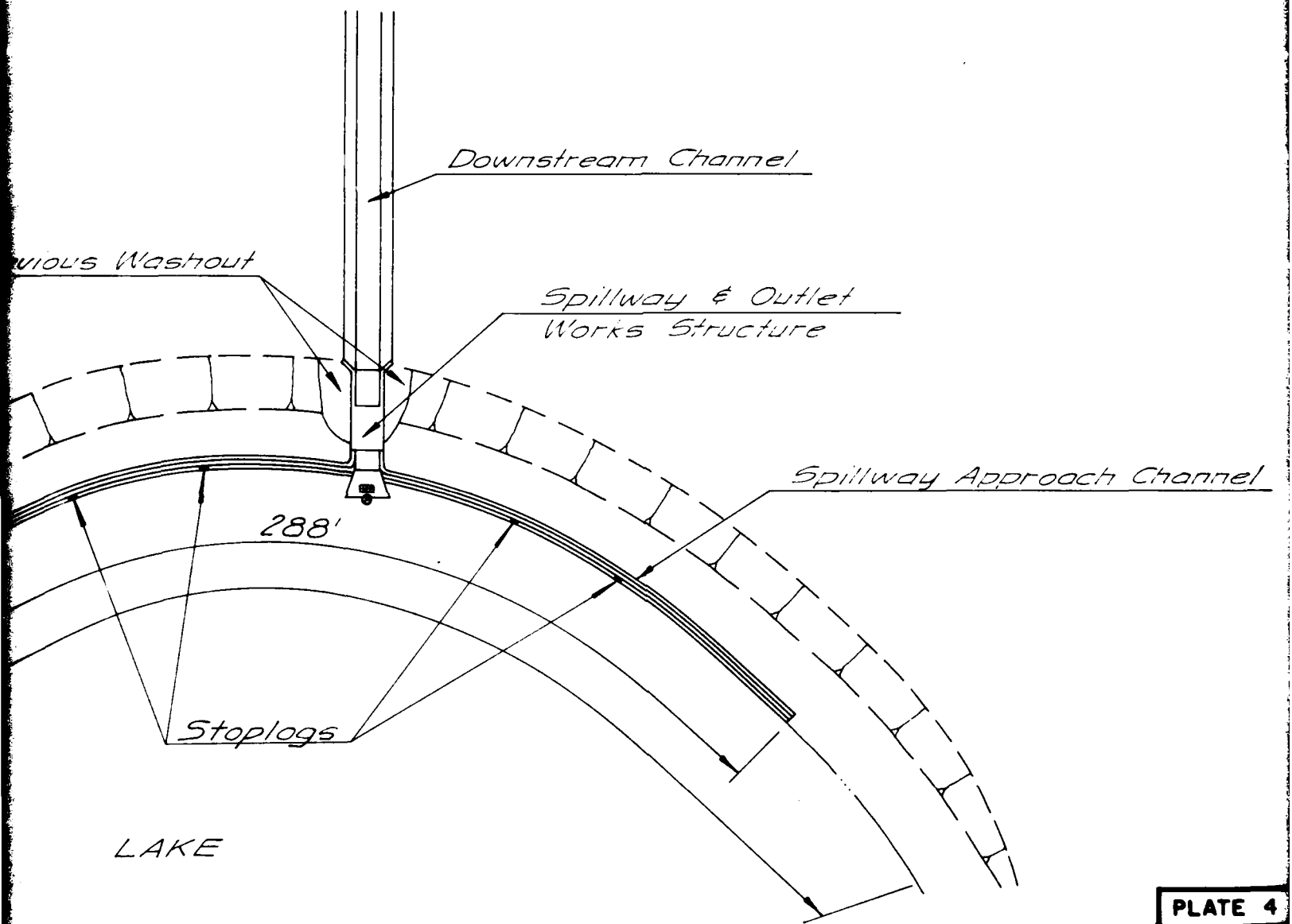


PLATE 4

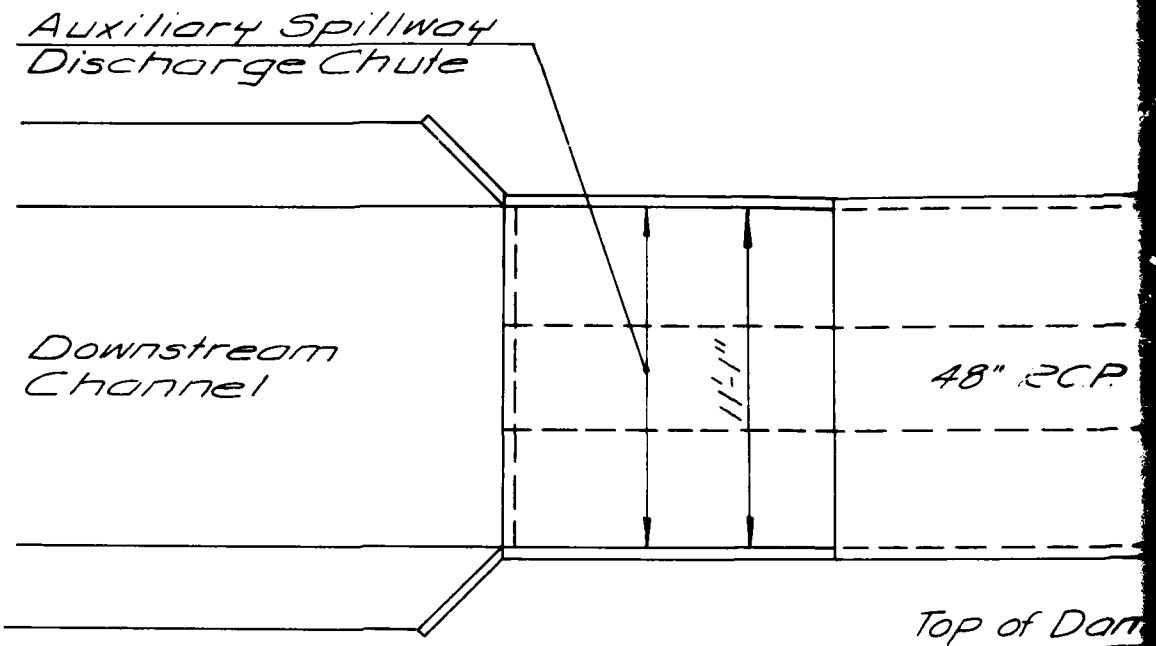
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCE N.J. DEPT. OF ENVIR. PROTECTIO TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

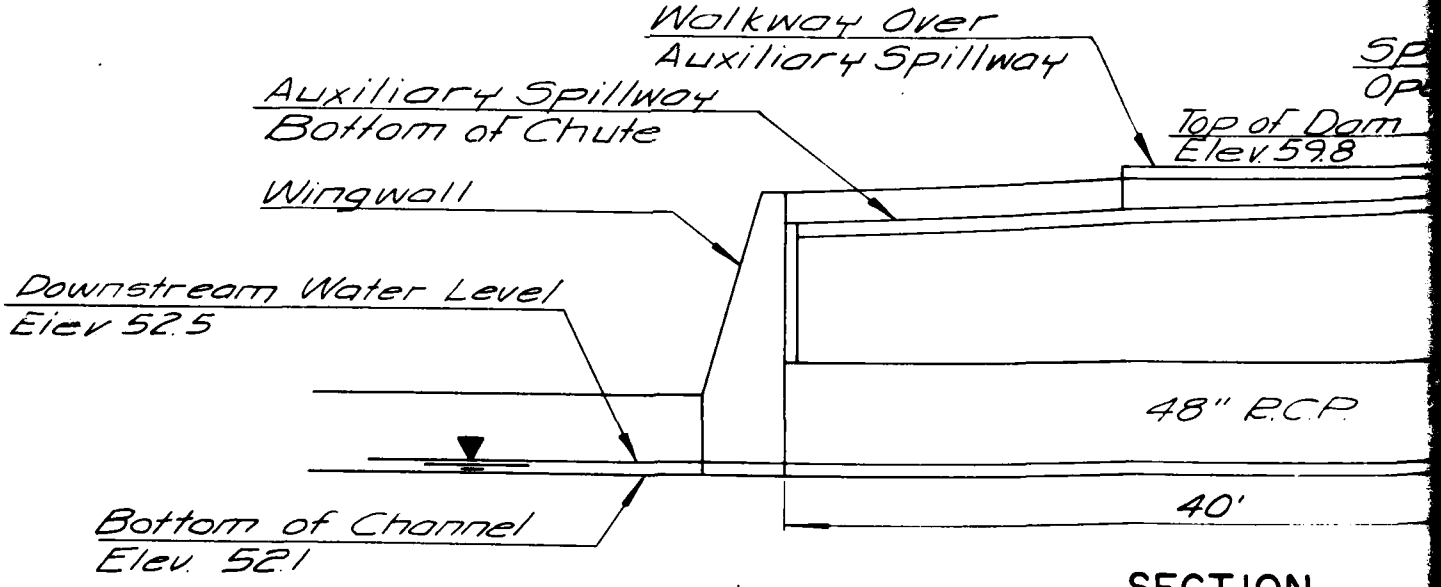
GENERAL PLAN

ROOSEVELT PARK DAM

I.D.N.J. 00378	SCALE: NOT TO SCALE
	DATE: DEC., 1979

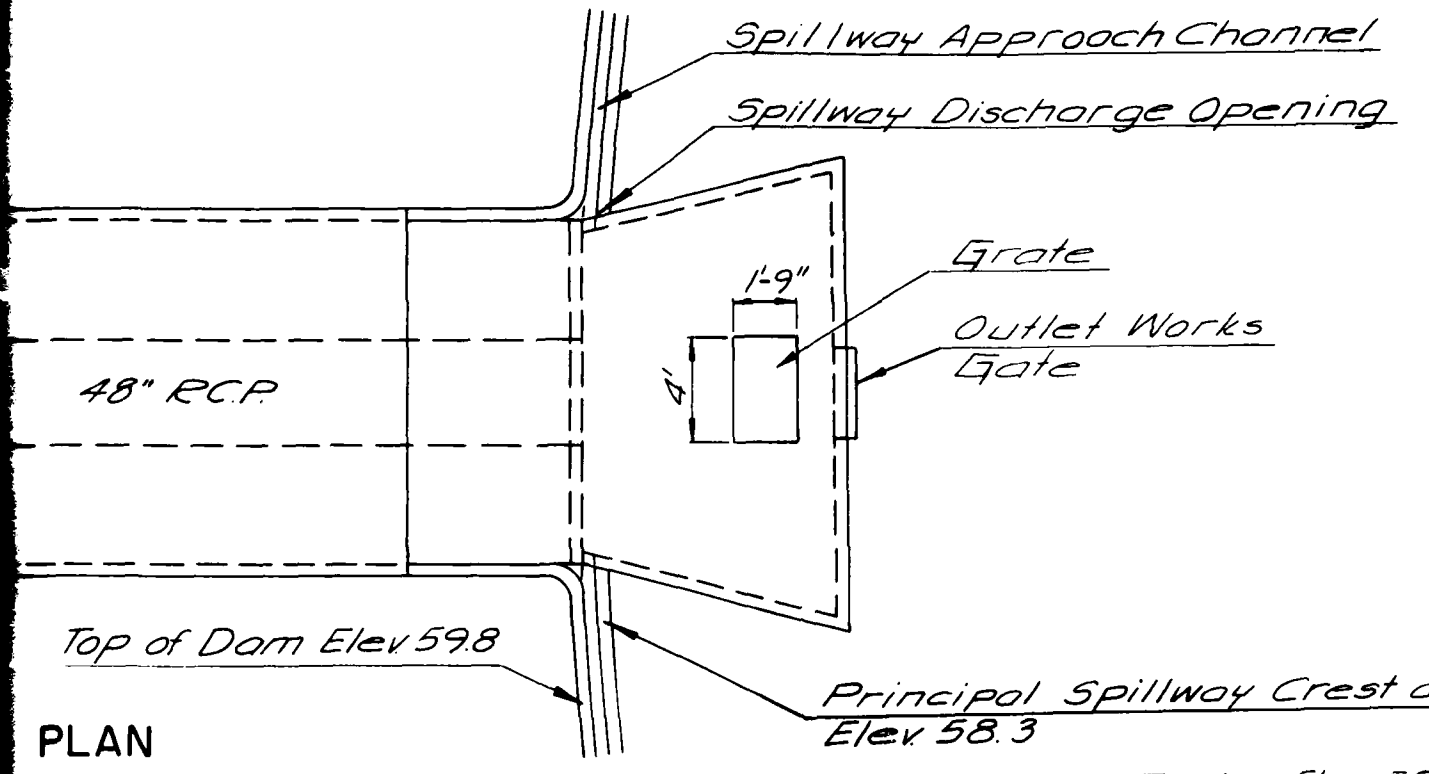


PLAN

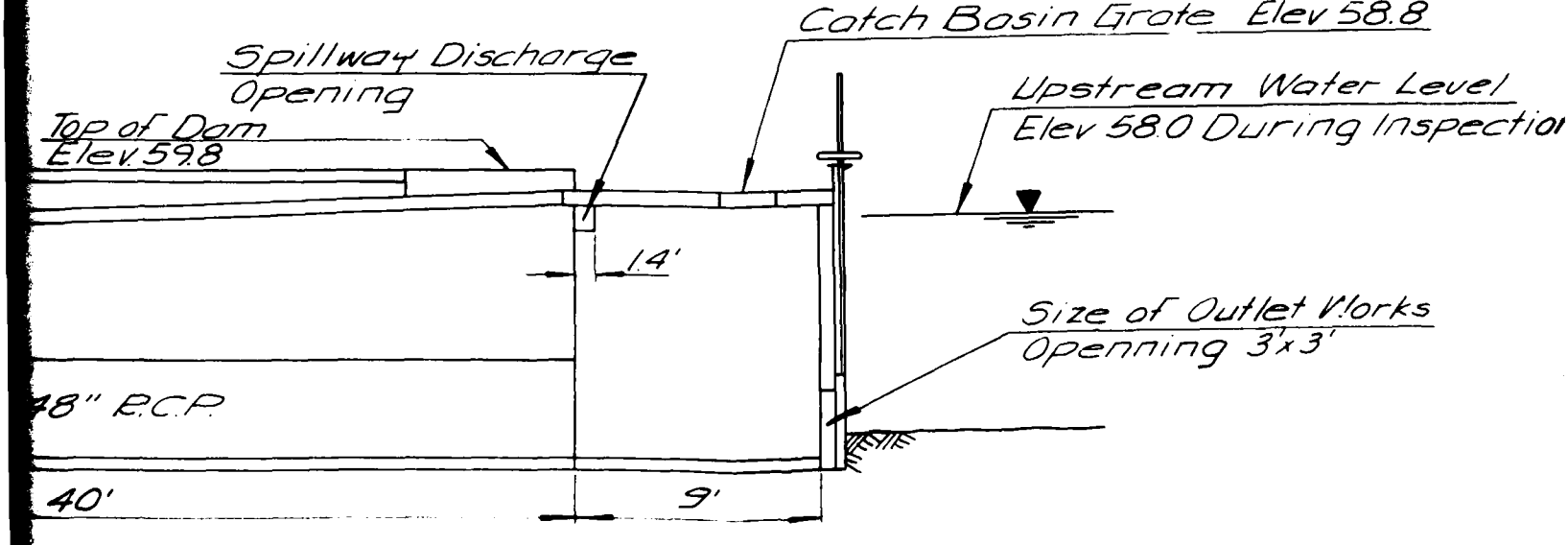


SECTION

NOTES:
1 Information taken from field inspection November 9, 1979.
2 Elevations based on N.G.V.D. Estimated from U.S.G.S. quadrangle



PLAN



ECTION

PLATE 5

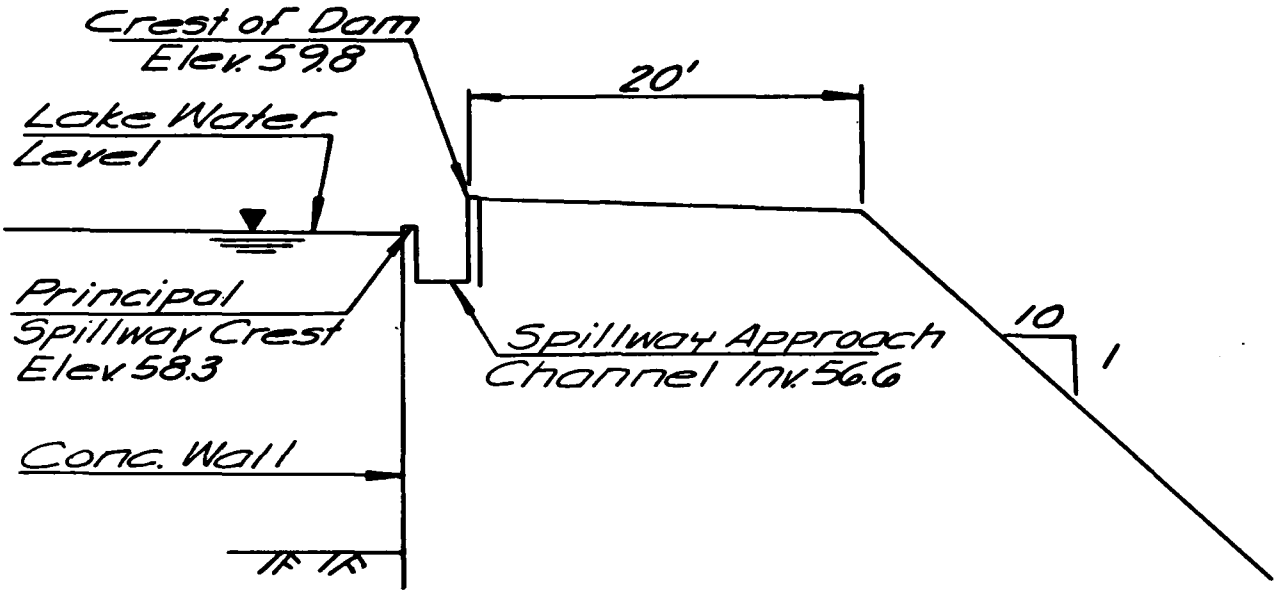
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCE N.J. DEPT. OF ENVIR. PROTECTI TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

SPILLWAY STRUCTURE

ROOSEVELT PARK DAM

I.D.N.J. 00378	SCALE NOT TO SCALE
	DATE: DEC., 1979

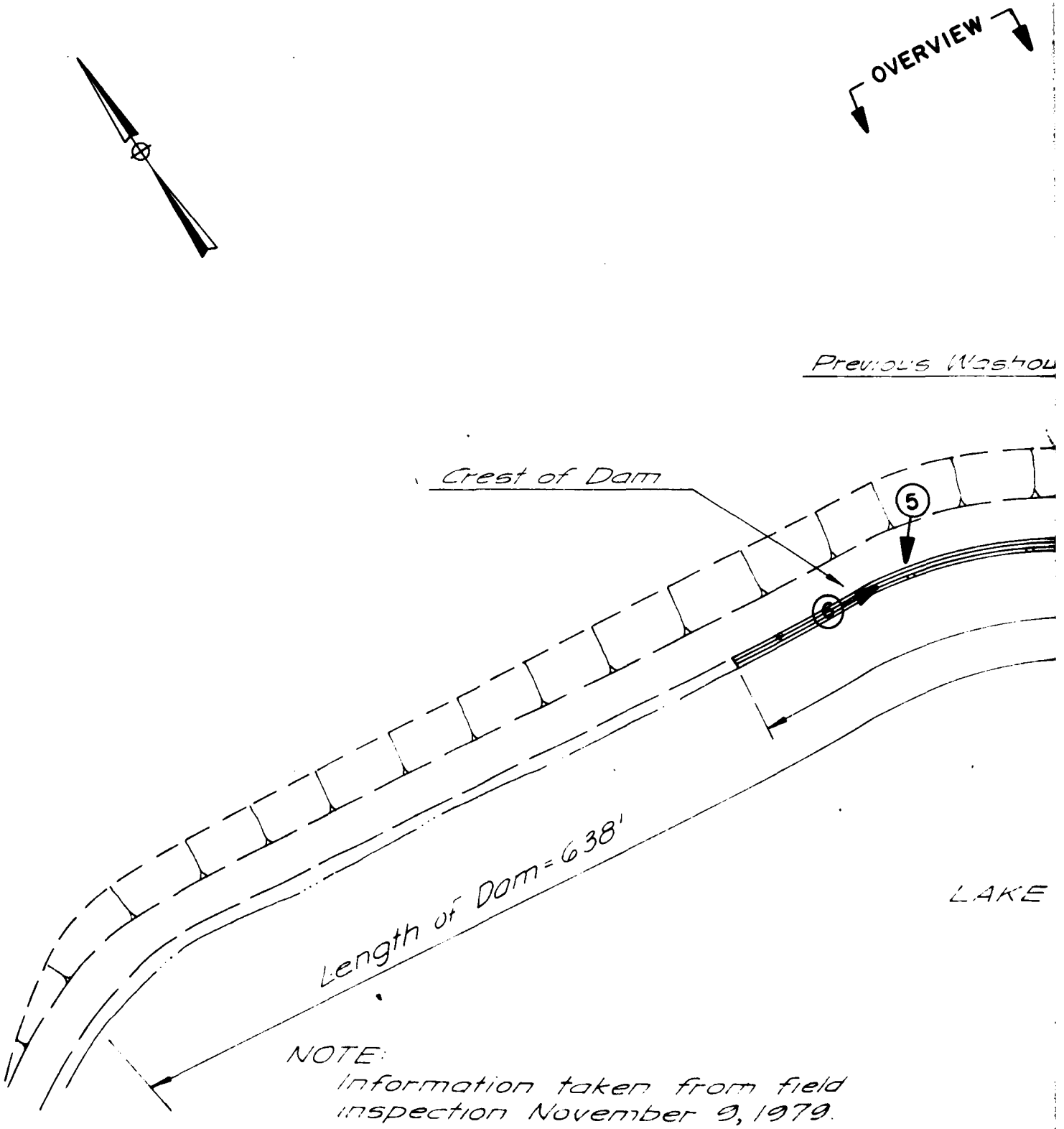


NOTES:

1. Information taken from field inspection November 9, 1979.
2. Elevations based on N.G.V.D. Estimated from U.S.G.S. quadrangle

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS DAM SECTION ROOSEVELT PARK DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00378 — SCALE: NOT TO SCALE DATE: DEC., 1979



NOTE:
Information taken from field inspection November 9, 1979.

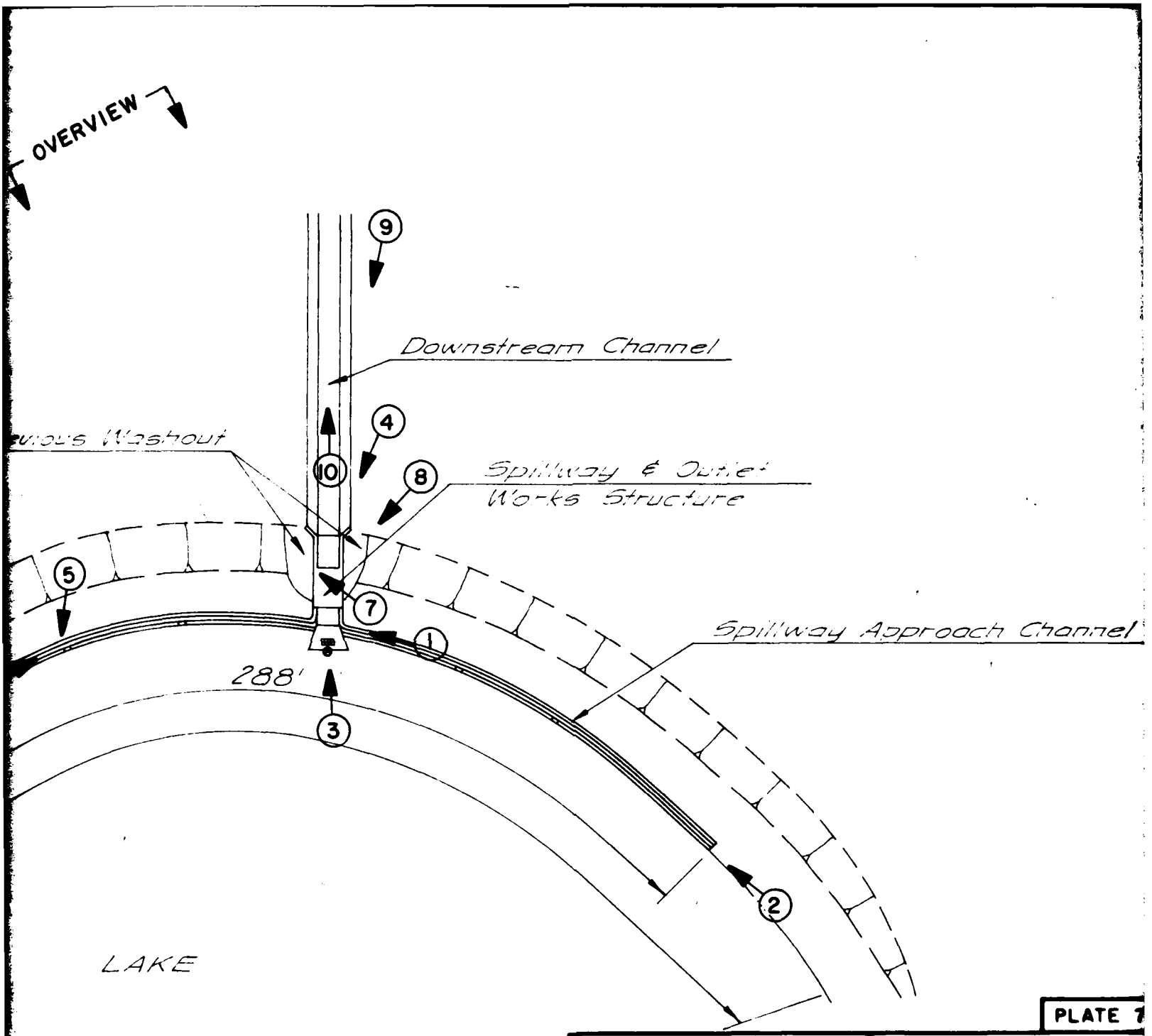


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCE N.J. DEPT. OF ENVIR. PROTECTI TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

ROOSEVELT PARK DAM

I.D.N.J. 00378	SCALE: NOT TO SCALE
	DATE: DEC., 1979

APPENDIX 1

Check List - Visual Inspection
Check List - Engineering Data

Check List
Visual Inspection
Phase I

Name of Dam Roosevelt Park Dam County Middlesex State New Jersey Coordinators NJDEP

Date(s) Inspection 11/9/79 Weather P-Cloudy Temperature 50°F

Pool Elevation at Time of Inspection 58.0 M.S.L. Tailwater at Time of Inspection 52.5 M.S.L.

Inspection Personnel:

John Gribbin
Alan Volle
Ronald Lai
Thomas Miller
Richard McDermott

J. Gribbin Recorder

Present: John Rusnak, Park Foreman

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Embankment generally grass covered with small trees on the downstream face. Gravel footpath along full length of crest.	Recommend removal of trees.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Evidence of previous washouts on each side of spillway structure. Dumped fill consisting of soil and large pieces of concrete and asphalt on each side of spillway structure.	Recommend regrading of embankment.
ANY NOTICEABLE SEEPAGE	None observed	
STAFF GAGE AND RECORDER	None observed	
DRAINS	None observed	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Several areas of erosion noted on downstream side of embankment. Erosion adjacent to downstream wingwalls of spillway structure.	Eroded conditions indicate frequent overtopping of dam.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: Generally level Horizontal: Curved	
RIPRAP FAILURES	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	48" RCP in generally satisfactory condition with minor spalling at invert.	
INTAKE STRUCTURE	Concrete deteriorated on each side of gate. Minor leakage at locations of bolts securing gate. Condition of majority of concrete satisfactory.	Recommend inspection and renovation if necessary.
OUTLET STRUCTURE	Same as outlet conduit.	
OUTLET CHANNEL	Outlet channel lined with cobble stones - satisfactory condition.	
GATE AND GATE HOUSING	Steel gate appeared to be in satisfactory condition. Gate operating stem bent. Padlock used to lock operating mechanism contains broken key.	Mechanism not operated at time of inspection. Recommend inspection and renovation if necessary. Recommend repair of lock.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CREST	Concrete and stoplogs are generally in satisfactory condition. One stoplog leaking around edges.	
APPROACH CHANNEL	Concrete wall on embankment side leaning at some locations. Steel anchors exposed at two locations. Wall supported by timber at one location. Concrete wall on lake side in generally satisfactory condition.	
CENTRAL SPILLWAY STRUCTURE	Structure generally stable. Some spalling observed at top.	
TRAINING WALLS	Spalling observed on both left and right training walls.	
CHUTE AND WALKWAY SLAB	Generally in satisfactory condition.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	N.A.	
OBSERVATION WELLS	N.A.	
WEIRS	N.A.	
PIEZOMETERS	N.A.	
OTHER	None	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Shore slopes range from 5% to 10%.	
SEDIMENTATION	Approximately 2 feet of sediment was measured in vicinity of outlet gate.	
STRUCTURES ALONG BANKS	Six culverts discharge into Roosevelt Lake. A foot bridge spans one end of lake.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Downstream is clean and straight with no significant obstructions between the dam and the Parsonage Road Bridge. Three downstream bridges within 1700' cause partial obstructions.	
SLOPES	Slopes of downstream channel banks are approximately 30%.	
STRUCTURES ALONG BANKS	No structures along the banks were observed for a distance of approx. 700 feet. Two housing developments were located near the channel within 2000 feet.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
DAM - PLAN	Available - Middlesex County Engineering Dept.
SECTIONS	
SPILLWAY - PLAN	Available - Middlesex County Engineering Dept.
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not Available
OUTLETS - PLAN	Available - Middlesex County Engineering Dept.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA	Not Available
RAINFALL/RESERVOIR RECORDS	Not Available
CONSTRUCTION HISTORY	Not Available
LOCATION MAP	Available - Middlesex County Engineering Dept.

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Not Available
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Evidence of washout adjacent to spillway was observed. Reportedly, the dam is overtopped every year.
MAINTENANCE OPERATION RECORDS	Not Available

APPENDIX 2

Photographs

PHOTO 1

SPILLWAY AND AUXILIARY SPILLWAY STRUCTURE

PHOTO 2

CREST AND UPSTREAM FACE OF DAM

ROOSEVELT PARK DAM

9 NOVEMBER 1979

PHOTO 3

OUTLET WORKS OPERATING MECHANISM

PHOTO 4

SPILLWAY AND OUTLET WORKS DISCHARGE

ROOSEVELT PARK DAM

9 NOVEMBER 1979

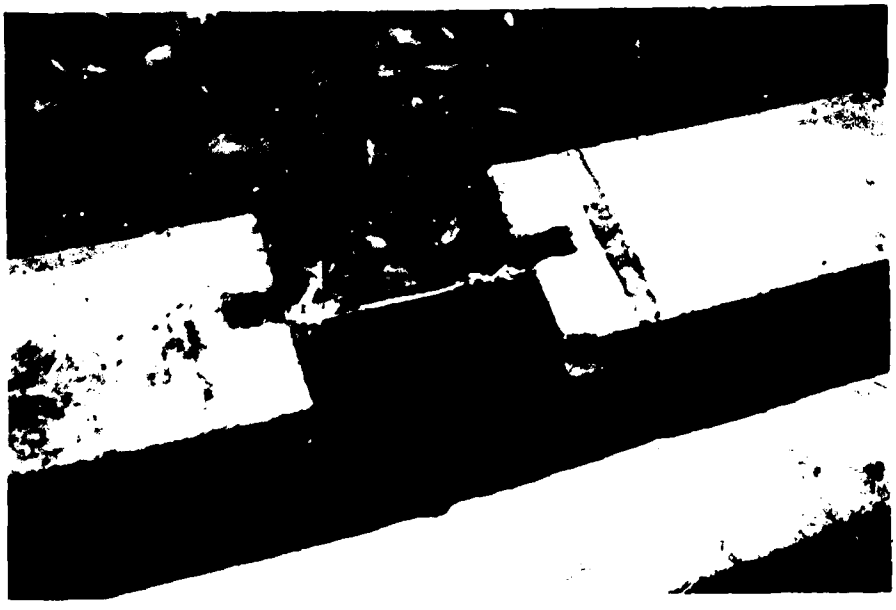


PHOTO 5

STOPLOG IN WEIR ALONG SPILLWAY APPROACH CHANNEL

PHOTO 6

DISPLACEMENT OF CONCRETE WALL ALONG SPILLWAY APPROACH CHANNEL

ROOSEVELT PARK DAM

9 NOVEMBER 1979

PHOTO 7

WASHOUT REPAIR AT
NORTH SIDE OF SPILLWAY STRUCTURE

PHOTO 8

WASHOUT REPAIR AT
SOUTH SIDE OF SPILLWAY STRUCTURE

ROOSEVELT PARK DAM
9 NOVEMBER 1979

PHOTO 9

DOWNSTREAM FACE OF DAM AND SPILLWAY DISCHARGE

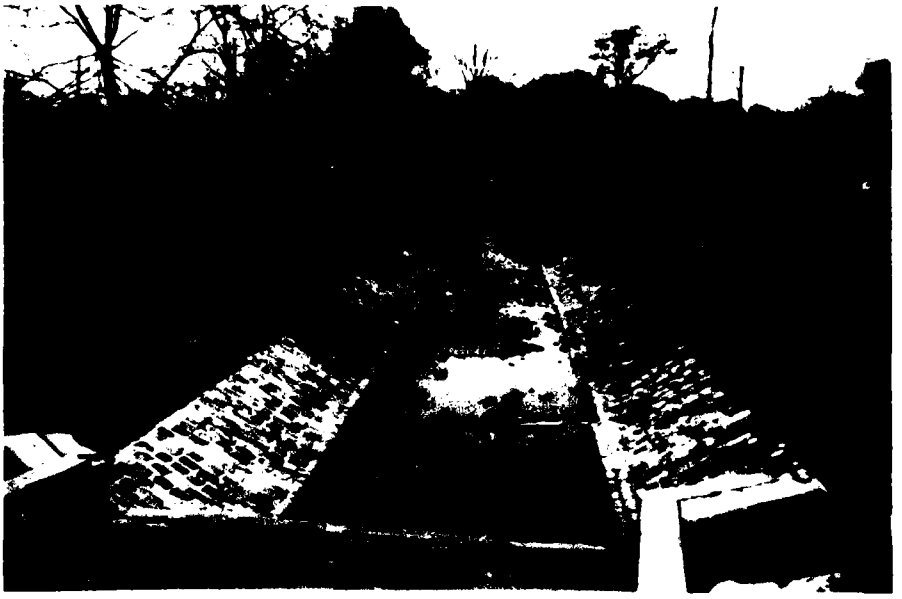


PHOTO 10

DOWNSTREAM CHANNEL

ROOSEVELT PARK DAM

9 NOVEMBER 1979

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 60% developed, 40% park

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 58.0 (26 Ac-ft)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 60.6

ELEVATION TOP DAM: 59.8

PRINCIPAL SPILLWAY CREST: Concrete Weir

a. Elevation 58.3

b. Type Broad Crested Weir

c. Width 1.5 feet

d. Length 273 feet

e. Location Spillover Opening on each side of spillway structure

f. Number and Type of Gates None

AUXILIARY SPILLWAY CREST: Grated Inlet and Chute

a. Elevation 58.4

b. Type Miscontrolled inlet and chute

c. Width N.A.

d. Length 10' Chute

e. Location Spillover Box inlet and end of chute at downstream channel

f. Number and Type of Gates None

OUTLET WORKS: Gated Sluice

a. Type 48" RCP with lfit gate

b. Location Center of Spillway

c. Entrance invert 52.1

d. Exit invert 52.1

e. Emergency draindown facilities: Sluice Gate

HYDROMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 113 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

Hydrology

Hydrologic Analysis

Runoff hydrograph will be developed by HEC-1-DB using SCS triangular hydrograph with the curvilinear transformation.

Drainage Area = 1.2 Sq. miles

Infiltration Data

Initial infiltration	1.0 in
Constant	0.1 in/hr.

Time of Concentration

By SCS TR-55 chart on overland flow and channel flow.

Overland flow	7,000 ft
Channel flow	1,500 ft
Average slope	1.6 %

$$T_c = \left(\frac{7000}{0.9} + \frac{1500}{1.8}\right)\frac{1}{3600}$$

$$\doteq \underline{2.4 \text{ hr.}}$$

Time of Concentration

By Pg 71 "Design of Small Dam" Nomograph

$$Tc = \left(\frac{11.9\,L^3}{H}\right)^{0.385}$$

Tc = Time of concentration in hrs.

L = Length of longest watercourse in miles

H = Elevation difference in feet

$$Tc = \left[\frac{(11.9)\,.\,(1.6)^3}{90}\right]^{0.385} = \underline{\underline{0.79 \text{ hr.}}}$$

Time of Concentration

By Gray's Method Pg 181 "Introduction to Hydrology" by Viessman et. al.

$L/\sqrt{S} = 1.53$ $P_R/\gamma' = 12$

$P_R = 43$ min

L = length of main stream in miles
S = slope in %
P_R = Period of rise (min) ≈ lag time
γ = shape and scale parameters

Lag time = $\underline{\underline{43 \text{ min}}} = 0.72$ hr.

Time of Concentration

by Kerby Pg 14-36
" Handbook of Applied Hydrology " Chow

$$t_c^{2.14} = \frac{2}{3}\,\frac{L_n}{\sqrt{S}}$$

t_c = time of concentration in min.
L = Length of overland flow in ft.
S = Slope
n = 0.4 (roughness coef)

$$t_c^{2.14} = \frac{2}{3}\,\frac{7000 \times 0.4}{\sqrt{0.016}}$$

t_c = 88.7 min
= 1.5 hr. for overland flow

Channel flow = 0.23 hr.

T_c = 1.73 hr.

Time of Concentration and Lag Time

T_c use 1.8 hr.

Lag = 0.6 T_c = 1.08 ≐ 1.1 hr.

Stage Discharge Calculation

Principal spillway consists of 273 feet of broad crested weir over which water flows into two spillway approach channels leading to the openings on both sides of a central spillway structure. Water then discharges through a 48" diameter pipe into the downstream channel.

Control of the principal spillway for a given headwater is the smallest of the following: weir flow, channel discharge, orifice discharge and 48" pipe capacity.

At W.L. 58.5 Orifice flow

$$Q = 0.6\,(2.5)\sqrt{2g\,(1.05)}$$

$$= 12.5 \text{ cfs}$$

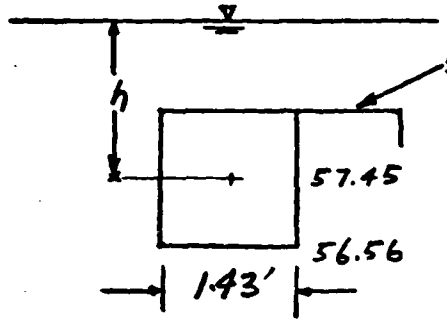
Weir flow

$$Q = CLh^{3/2}$$

$$3.3 \times 273 \times (58.5 - 58.3)^{1.5} = 81 \text{ cfs}$$

For W.L. over 58.5, orifice flow will control. Thus

$$Q = 0.6\,A\sqrt{2gh}$$



Principal Spillway Crest

$A = 2.55\ ft^2$

Principal Spillway Stage Discharge

Water Level (ft)	Q (cfs) 2 orifices
58.0	0
59.0	30.6
59.8 Top of Dam	37.6
60.0	39.2
61.0	46.2
62.0	52.4
63.0	57.8

Max. capacity of 48" RCP = 110 cfs

for HW/D = 1.5 using inlet control chart

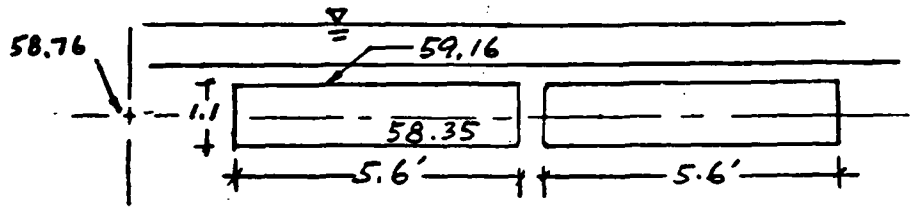
"Hydraulic Charts For Highway Culverts"

Auxillary Spillway consists of one catch basin grate and a concrete chute located on top of the central spillway structure.

Flow thru grate use $Q = 0.6A\sqrt{2gh}$

Assume ½ area open $A = 3.6\ ft^2$

Flow thru orifice: use same formula with $A = 12.3\ ft^2$



Rim of catch basin at elev. 58.84

Auxillary Spillway Stage Discharge Data

Water Level (ft)	Q (cfs) Orifice	Q (cfs) CB.	Q (cfs) Total
58.0	0	0	0
59.0	29.0	6.9	35.9
60.0	65.9	18.7	84.6
61.0	88.6	25.4	114.0
62.0	106.6	30.7	137.3
63.0	122.0	35.4	157.4

Stage Discharge Tabulation

For Spillways

Water Level (ft)	Q(cfs) Principal Spillway	Q (cfs) Auxillary Spillway	Q (cfs) Total
58	0	0	0
59	30.6	35.9	66.5
60	39.2	84.6	123.8
61	46.2	114.0	160.2
62	52.4	137.3	189.7
63	57.8	157.4	215.2

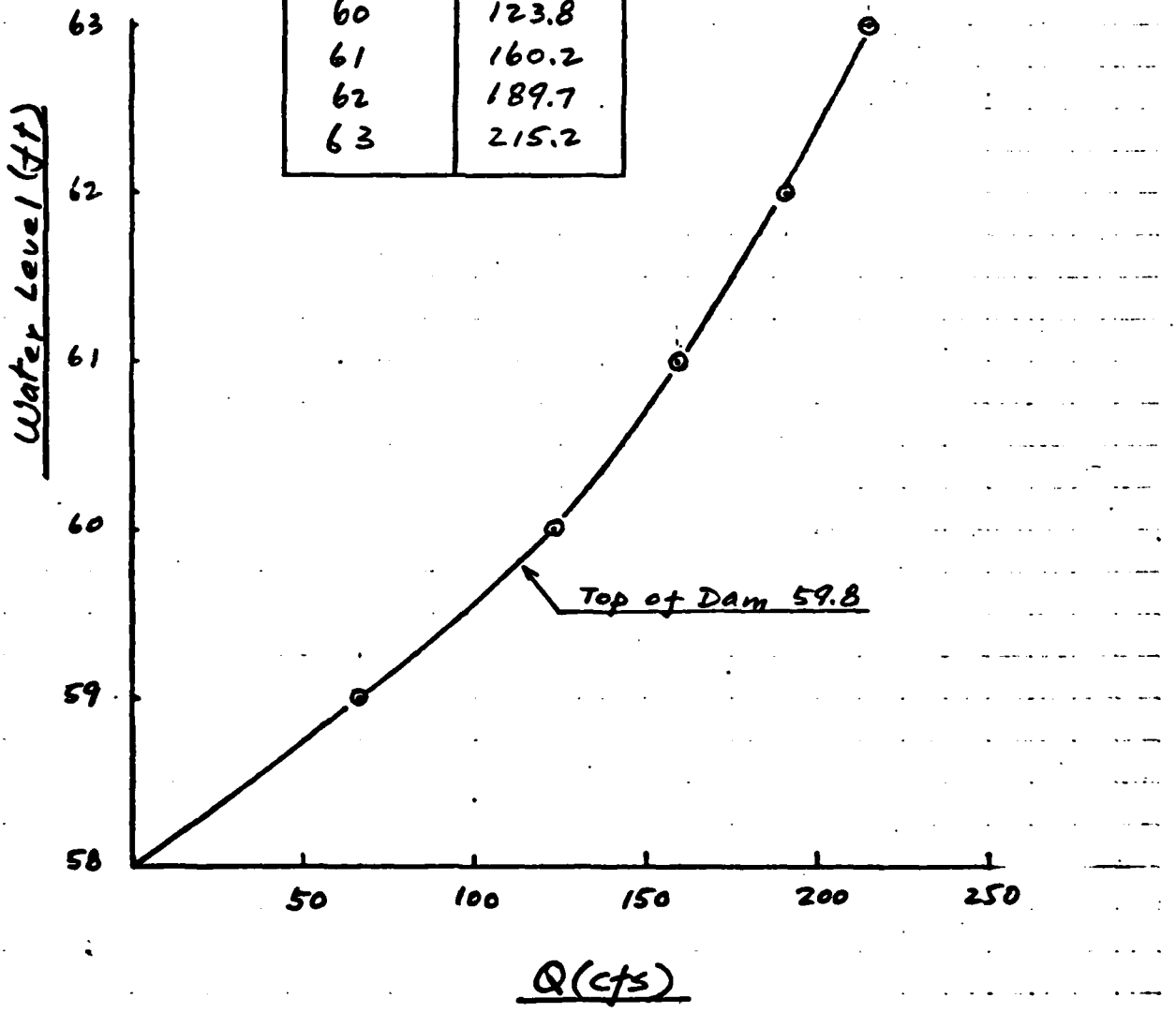
59.8 (Top of Dam) 112.5 cfs

Total length of dam 638 ft.

Flow over dam is in HEC-2-DB analysis

Stage Discharge Curve

W.L (ft)	Q (cfs)
58	0
59	66.5
60	123.8
61	160.2
62	189.7
63	215.2



Elevation - Area Table

Information from USGS & Aerial Photos

Elev. (MSL)	Area (Ac)
58	10.9
60	37.7
80	87.2

Dam Crest Elevation 59.8 MSL

Length of Dam 638 feet

Capacity of Outlet Works

Outlet gate 3'x3' (Assume no inflow)

$Q = 0.6A\sqrt{2gh}$

To drain lake completely

h averages to 3 feet

$Q_{avg} = 0.6(9)\sqrt{2g(3)}$

$= \underline{75}$ cfs

Estimated drawdown time $= \frac{26(43560)}{75(3600)}$

$= \underline{4.2}$ hr

24 hr. 100 yr. rainstorm Distribution For Roosevelt Park Dam

Time (hr)	Rain (Inches)
1	0.08
2	0.08
3	0.08
4	0.08
5	0.08
6	0.08
7	0.09
8	0.09
9	0.18
10	0.18
11	0.18
12	0.19
13	0.3
14	0.3
15	0.8
16	3.0
17	0.4
18	0.3
19	0.19
20	0.18
21	0.09
22	0.09
23	0.08
24	0.08
	7.2

From TP40 US Weather Bureau

HEC-1-DB COMPUTATIONS

```
A1              NATIONAL DAM SAFETY PROGRAM
A2             ROOSEVELT PARK DAM    NEW JERSEY
A3           100 YR. STORM ROUTING
B     150        0        20                                          0         0         3
B1      5
J       1        1         1
J1      1
K                LAKE                                                 1
K1          INFLOW HYDROGRAPH TO ROOSEVELT DAM
M       0        2       1.2                 1.2                                          1
P      72
O1  0.027    0.027     0.027     0.027     0.027     0.027     0.027     0.027     0.027     0.027
O1  0.027    0.027     0.027     0.027     0.027     0.027     0.027     0.027      0.03      0.03
O1   0.03     0.03      0.03      0.03      0.06      0.06      0.06      0.06      0.06      0.06
O1   0.06     0.06      0.06     0.063     0.063     0.063       0.1       0.1       0.1       0.1
O1    0.1      0.1      0.27      0.27      0.27       1.0       1.0       1.0      0.13      0.13
O1   0.13      0.1       0.1       0.1     0.063     0.063     0.063      0.06      0.06      0.06
O1   0.03     0.03      0.03      0.03      0.03      0.03     0.027     0.027     0.027     0.027
O1  0.027    0.027
T                                                                   1.0       0.1
W2                1.1
X    -1.0    -0.?5       2.0
K       1      DAM                                  0         0         1
K1               ROUTE DISCHARGE THRU DAM
Y                                         1         1
Y1      1                                                         -58.3        -1
Y4     58       59      59.8        60        61        62        63
Y5      0     66.5       113     123.8     160.2     189.7     215.2
$A      0     1?.9      37.7      87.2
$E     51       58        60        80
$$   58.3
$D   59.8     2.63       1.5       638
K      99
A
A
A
A
A
```

NATIONAL DAM SAFETY PROGRAM
ROOSEVELT PARK DAM NEW JERSEY
100 YR. STORM ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	20	0	0	0	0	0	3	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO ROOSEVELT DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	1.20	0.00	1.20	0.00	0.000	0	1	0

PRECIP DATA

NP	STORM	DAJ	DAK
72	0.00	0.00	0.00

PRECIP PATTERN

.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.03	.03	.03	.03	.06	.06	.06	.06	.06	.06
.06	.06	.06	.06	.06	.06	.10	.10	.10	.10
.10	.10	.27	.27	.27	1.00	1.00	1.00	.13	.13
.13	.10	.10	.10	.06	.06	.06	.06	.06	.06
.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.03	.03								

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 1.10

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 18 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 1.10 VOL= 1.00

72.	238.	420.	455.	388.	268.	167.	111.	72.	47.
30.	20.	13.	8.	6.	4.	2.	1.		

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.20	1	.03	0.00	.03	1.
1.01	.40	2	.03	0.00	.03	1.
1.01	1.00	3	.03	0.00	.03	1.
1.01	1.20	4	.03	0.00	.03	1.
1.01	1.40	5	.03	0.00	.03	1.
1.01	2.00	6	.03	0.00	.03	1.
1.01	2.20	7	.03	0.00	.03	1.
1.01	2.40	8	.03	0.00	.03	1.
1.01	3.00	9	.03	0.00	.03	1.
1.01	3.20	10	.03	0.00	.03	1.
1.01	3.40	11	.03	0.00	.03	1.
1.01	4.00	12	.03	0.00	.03	1.
1.01	4.20	13	.03	0.00	.03	0.
1.01	4.40	14	.03	0.00	.03	0.
1.01	5.00	15	.03	0.00	.03	0.
1.01	5.20	16	.03	0.00	.03	0.
1.01	5.40	17	.03	0.00	.03	0.
1.01	6.00	18	.03	0.00	.03	0.
1.01	6.20	19	.03	0.00	.03	0.
1.01	6.40	20	.03	0.00	.03	0.
1.01	7.00	21	.03	0.00	.03	0.
1.01	7.20	22	.03	0.00	.03	0.
1.01	7.40	23	.03	0.00	.03	0.
1.01	8.00	24	.03	0.00	.03	0.
1.01	8.20	25	.06	0.00	.06	0.
1.01	8.40	26	.06	0.00	.06	0.
1.01	9.00	27	.06	0.00	.06	0.
1.01	9.20	28	.06	0.00	.06	0.
1.01	9.40	29	.06	0.00	.06	0.
1.01	10.00	30	.06	.01	.05	1.
1.01	10.20	31	.06	.03	.03	3.
1.01	10.40	32	.06	.03	.03	13.
1.01	11.00	33	.06	.03	.03	25.
1.01	11.20	34	.06	.03	.03	36.
1.01	11.40	35	.06	.03	.03	46.
1.01	12.00	36	.06	.03	.03	53.
1.01	12.20	37	.10	.07	.03	61.
1.01	12.40	38	.10	.07	.03	74.
1.01	13.00	39	.10	.07	.03	92.
1.01	13.20	40	.10	.07	.03	110.
1.01	13.40	41	.10	.07	.03	125.
1.01	14.00	42	.10	.07	.03	136.
1.01	14.20	43	.27	.24	.03	155.
1.01	14.40	44	.27	.24	.03	200.
1.01	15.00	45	.27	.24	.03	274.
1.01	15.20	46	1.00	.97	.03	406.
1.01	15.40	47	1.00	.97	.03	646.
1.01	16.00	48	1.00	.97	.03	1000.
1.01	16.20	49	.13	.10	.03	1298.
1.01	16.40	50	.13	.10	.03	1394.
1.01	17.00	51	.13	.10	.03	1236.
1.01	17.20	52	.10	.07	.03	968.
1.01	17.40	53	.10	.07	.03	709.
1.01	18.00	54	.10	.07	.03	519.
1.01	18.20	55	.06	.03	.03	394.
1.01	18.40	56	.06	.03	.03	301.
1.01	19.00	57	.06	.03	.03	230.
1.01	19.20	58	.06	.03	.03	177.
1.01	19.40	59	.06	.03	.03	139.
1.01	20.00	60	.06	.03	.03	113.
1.01	20.20	61	.03	0.00	.03	94.
1.01	20.40	62	.03	0.00	.03	76.
1.01	21.00	63	.03	0.00	.03	66.
1.01	21.20	64	.03	0.00	.03	62.
1.01	21.40	65	.03	0.00	.03	58.
1.01	22.00	66	.03	0.00	.03	54.
1.01	22.20	67	.03	0.00	.03	50.
1.01	22.40	68	.03	0.00	.03	47.
1.01	23.00	69	.03	0.00	.03	44.
1.01	23.20	70	.03	0.00	.03	41.
1.01	23.40	71	.03	0.00	.03	38.
1.02	.00	72	.03	0.00	.03	36.
1.02	.20	73	0.00	0.00	0.00	33.
1.02	.40	74	0.00	0.00	0.00	31.
1.02	1.00	75	0.00	0.00	0.00	29.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.02	1.20	76	0.00	0.00	0.00	27.
1.02	1.40	77	0.00	0.00	0.00	25.
1.02	2.00	78	0.00	0.00	0.00	23.
1.02	2.20	79	0.00	0.00	0.00	22.
1.02	2.40	80	0.00	0.00	0.00	20.
1.02	3.00	81	0.00	0.00	0.00	19.
1.02	3.20	82	0.00	0.00	0.00	18.
1.02	3.40	83	0.00	0.00	0.00	17.
1.02	4.00	84	0.00	0.00	0.00	15.
1.02	4.20	85	0.00	0.00	0.00	14.
1.02	4.40	86	0.00	0.00	0.00	13.
1.02	5.00	87	0.00	0.00	0.00	13.
1.02	5.20	88	0.00	0.00	0.00	12.
1.02	5.40	89	0.00	0.00	0.00	11.
1.02	6.00	90	0.00	0.00	0.00	10.
1.02	6.20	91	0.00	0.00	0.00	10.
1.02	6.40	92	0.00	0.00	0.00	9.
1.02	7.00	93	0.00	0.00	0.00	8.
1.02	7.20	94	0.00	0.00	0.00	8.
1.02	7.40	95	0.00	0.00	0.00	7.
1.02	8.00	96	0.00	0.00	0.00	7.
1.02	8.20	97	0.00	0.00	0.00	6.
1.02	8.40	98	0.00	0.00	0.00	6.
1.02	9.00	99	0.00	0.00	0.00	5.
1.02	9.20	100	0.00	0.00	0.00	5.
1.02	9.40	101	0.00	0.00	0.00	5.
1.02	10.00	102	0.00	0.00	0.00	4.
1.02	10.20	103	0.00	0.00	0.00	4.
1.02	10.40	104	0.00	0.00	0.00	4.
1.02	11.00	105	0.00	0.00	0.00	4.
1.02	11.20	106	0.00	0.00	0.00	3.
1.02	11.40	107	0.00	0.00	0.00	3.
1.02	12.00	108	0.00	0.00	0.00	3.
1.02	12.20	109	0.00	0.00	0.00	3.
1.02	12.40	110	0.00	0.00	0.00	3.
1.02	13.00	111	0.00	0.00	0.00	2.
1.02	13.20	112	0.00	0.00	0.00	2.
1.02	13.40	113	0.00	0.00	0.00	2.
1.02	14.00	114	0.00	0.00	0.00	2.
1.02	14.20	115	0.00	0.00	0.00	2.
1.02	14.40	116	0.00	0.00	0.00	2.
1.02	15.00	117	0.00	0.00	0.00	2.
1.02	15.20	118	0.00	0.00	0.00	1.
1.02	15.40	119	0.00	0.00	0.00	1.
1.02	16.00	120	0.00	0.00	0.00	1.
1.02	16.20	121	0.00	0.00	0.00	1.
1.02	16.40	122	0.00	0.00	0.00	1.
1.02	17.00	123	0.00	0.00	0.00	1.
1.02	17.20	124	0.00	0.00	0.00	1.
1.02	17.40	125	0.00	0.00	0.00	1.
1.02	18.00	126	0.00	0.00	0.00	1.
1.02	18.20	127	0.00	0.00	0.00	1.
1.02	18.40	128	0.00	0.00	0.00	1.
1.02	19.00	129	0.00	0.00	0.00	1.
1.02	19.20	130	0.00	0.00	0.00	1.
1.02	19.40	131	0.00	0.00	0.00	1.
1.02	20.00	132	0.00	0.00	0.00	1.
1.02	20.20	133	0.00	0.00	0.00	1.
1.02	20.40	134	0.00	0.00	0.00	0.
1.02	21.00	135	0.00	0.00	0.00	0.
1.02	21.20	136	0.00	0.00	0.00	0.
1.02	21.40	137	0.00	0.00	0.00	0.
1.02	22.00	138	0.00	0.00	0.00	0.
1.02	22.20	139	0.00	0.00	0.00	0.
1.02	22.40	140	0.00	0.00	0.00	0.
1.02	23.00	141	0.00	0.00	0.00	0.
1.02	23.20	142	0.00	0.00	0.00	0.
1.02	23.40	143	0.00	0.00	0.00	0.
1.03	0.00	144	0.00	0.00	0.00	0.
1.03	.20	145	0.00	0.00	0.00	0.
1.03	.40	146	0.00	0.00	0.00	0.
1.03	1.00	147	0.00	0.00	0.00	0.
1.03	1.20	148	0.00	0.00	0.00	0.
1.03	1.40	149	0.00	0.00	0.00	0.
1.03	2.00	150	0.00	0.00	0.00	0.
		SUM	7.21	4.85	2.36	12103.
			(183.)(	123.)(	60.)(	342.72)

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HYDROGRAPH ROUTING

ROUTE DISCHARGE THRU DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-58.	-1

STAGE	58.00	59.00	59.80	60.00	61.00	62.00	63.00
FLOW	0.00	66.50	113.00	123.80	160.20	189.70	215.20
SURFACE AREA=	0.	11.	38.	87.			
CAPACITY=	0.	25.	71.	1286.			
ELEVATION=	51.	58.	60.	80.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
58.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
59.8	2.6	1.5	638.

STATION DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.20	1	.33	1.	18.	29.	58.3
1.01	.40	2	.67	1.	15.	28.	58.2
1.01	1.00	3	1.00	1.	14.	28.	58.2
1.01	1.20	4	1.33	1.	12.	28.	58.2
1.01	1.40	5	1.67	1.	11.	27.	58.2
1.01	2.00	6	2.00	1.	9.	27.	58.1
1.01	2.20	7	2.33	1.	8.	27.	58.1
1.01	2.40	8	2.67	1.	7.	27.	58.1
1.01	3.00	9	3.00	1.	6.	27.	58.1
1.01	3.20	10	3.33	1.	6.	26.	58.1
1.01	3.40	11	3.67	1.	5.	26.	58.1
1.01	4.00	12	4.00	1.	4.	26.	58.1
1.01	4.20	13	4.33	1.	4.	26.	58.1
1.01	4.40	14	4.67	1.	3.	26.	58.1
1.01	5.00	15	5.00	0.	3.	26.	58.0
1.01	5.20	16	5.33	0.	3.	26.	58.0
1.01	5.40	17	5.67	0.	2.	26.	58.0
1.01	6.00	18	6.00	0.	2.	26.	58.0
1.01	6.20	19	6.33	0.	2.	26.	58.0
1.01	6.40	20	6.67	0.	2.	26.	58.0
1.01	7.00	21	7.00	0.	1.	26.	58.0
1.01	7.20	22	7.33	0.	1.	26.	58.0
1.01	7.40	23	7.67	0.	1.	26.	58.0
1.01	8.00	24	8.00	0.	1.	26.	58.0
1.01	8.20	25	8.33	0.	1.	26.	58.0
1.01	8.40	26	8.67	0.	1.	26.	58.0
1.01	9.00	27	9.00	0.	1.	26.	58.0
1.01	9.20	28	9.33	0.	1.	26.	58.0
1.01	9.40	29	9.67	0.	1.	26.	58.0
1.01	10.00	30	10.00	1.	1.	26.	58.0
1.01	10.20	31	10.33	5.	2.	26.	58.0
1.01	10.40	32	10.67	13.	5.	26.	58.0
1.01	11.00	33	11.00	25.	8.	27.	58.1
1.01	11.20	34	11.33	36.	13.	28.	58.2
1.01	11.40	35	11.67	46.	18.	29.	58.3
1.01	12.00	36	12.00	53.	23.	30.	58.3
1.01	12.20	37	12.33	61.	28.	31.	58.4
1.01	12.40	38	12.67	74.	34.	32.	58.5
1.01	13.00	39	13.00	92.	41.	34.	58.6
1.01	13.20	40	13.33	110.	48.	36.	58.7
1.01	13.40	41	13.67	125.	56.	38.	58.8
1.01	14.00	42	14.00	136.	63.	41.	58.9
1.01	14.20	43	14.33	155.	71.	44.	59.1
1.01	14.40	44	14.67	200.	82.	48.	59.3
1.01	15.00	45	15.00	274.	96.	55.	59.5
1.01	15.20	46	15.33	406.	140.	66.	59.9
1.01	15.40	47	15.67	646.	565.	79.	60.2
1.01	16.00	48	16.00	1000.	1034.	89.	60.5
1.01	16.20	49	16.33	1298.	1306.	94.	60.6
1.01	16.40	50	16.67	1394.	1314.	94.	60.6
1.01	17.00	51	17.00	1236.	1127.	90.	60.5
1.01	17.20	52	17.33	966.	883.	86.	60.4
1.01	17.40	53	17.67	709.	668.	81.	60.3
1.01	18.00	54	18.00	519.	509.	78.	60.2
1.01	18.20	55	18.33	394.	396.	75.	60.1
1.01	18.40	56	18.67	301.	311.	73.	60.0
1.01	19.00	57	19.00	230.	246.	70.	59.9
1.01	19.20	58	19.33	177.	197.	69.	59.9
1.01	19.40	59	19.67	139.	161.	67.	59.9
1.01	20.00	60	20.00	113.	136.	66.	59.9
1.01	20.20	61	20.33	94.	118.	65.	59.8
1.01	20.40	62	20.67	76.	112.	64.	59.8
1.01	21.00	63	21.00	66.	110.	62.	59.7
1.01	21.20	64	21.33	62.	107.	61.	59.7
1.01	21.40	65	21.67	58.	105.	60.	59.7
1.01	22.00	66	22.00	54.	102.	59.	59.6
1.01	22.20	67	22.33	50.	102.	59.	59.6
1.01	22.40	68	22.67	47.	100.	59.	59.6
1.01	23.00	69	23.00	44.	97.	59.	59.5

1.01	23.20	70	23.33	41.	94.	54.	59.5
1.01	23.40	71	23.67	38.	91.	52.	59.4
1.02	0.00	72	24.00	36.	88.	51.	59.4
1.02	.20	73	24.33	33.	85.	49.	59.3
1.02	.40	74	24.67	31.	82.	48.	59.3
1.02	1.00	75	25.00	29.	79.	47.	59.2
1.02	1.20	76	25.33	27.	75.	45.	59.2
1.02	1.40	77	25.67	25.	72.	44.	59.1
1.02	2.00	78	26.00	23.	69.	43.	59.0
1.02	2.20	79	26.33	22.	66.	41.	59.0
1.02	2.40	80	26.67	20.	62.	40.	58.9
1.02	3.00	81	27.00	19.	59.	39.	58.9
1.02	3.20	82	27.33	18.	55.	38.	58.8
1.02	3.40	83	27.67	17.	52.	37.	58.8
1.02	4.00	84	28.00	15.	49.	36.	58.7
1.02	4.20	85	28.33	14.	45.	35.	58.7
1.02	4.40	86	28.67	13.	42.	34.	58.6
1.02	5.00	87	29.00	13.	39.	34.	58.6
1.02	5.20	88	29.33	12.	37.	33.	58.6
1.02	5.40	89	29.67	11.	34.	32.	58.5
1.02	6.00	90	30.00	10.	31.	32.	58.5
1.02	6.20	91	30.33	10.	29.	31.	58.4
1.02	6.40	92	30.67	9.	27.	31.	58.4
1.02	7.00	93	31.00	8.	25.	30.	58.4
1.02	7.20	94	31.33	8.	23.	30.	58.3
1.02	7.40	95	31.67	7.	21.	29.	58.3
1.02	8.00	96	32.00	7.	19.	29.	58.3
1.02	8.20	97	32.33	6.	18.	29.	58.3
1.02	8.40	98	32.67	6.	16.	28.	58.2
1.02	9.00	99	33.00	5.	15.	28.	58.2
1.02	9.20	100	33.33	5.	14.	28.	58.2
1.02	9.40	101	33.67	5.	13.	28.	58.2
1.02	10.00	102	34.00	4.	12.	28.	58.2
1.02	10.20	103	34.33	4.	11.	27.	58.2
1.02	10.40	104	34.67	4.	10.	27.	58.2
1.02	11.00	105	35.00	4.	9.	27.	58.1
1.02	11.20	106	35.33	3.	9.	27.	58.1
1.02	11.40	107	35.67	3.	8.	27.	58.1
1.02	12.00	108	36.00	3.	7.	27.	58.1
1.02	12.20	109	36.33	3.	7.	27.	58.1
1.02	12.40	110	36.67	3.	6.	26.	58.1
1.02	13.00	111	37.00	2.	6.	26.	58.1
1.02	13.20	112	37.33	2.	5.	26.	58.1
1.02	13.40	113	37.67	2.	5.	26.	58.1
1.02	14.00	114	38.00	2.	4.	26.	58.1
1.02	14.20	115	38.33	2.	4.	26.	58.1
1.02	14.40	116	38.67	2.	4.	26.	58.1
1.02	15.00	117	39.00	2.	3.	26.	58.1
1.02	15.20	118	39.33	1.	3.	26.	58.0
1.02	15.40	119	39.67	1.	3.	26.	58.0
1.02	16.00	120	40.00	1.	3.	26.	58.0
1.02	16.20	121	40.33	1.	3.	26.	58.0
1.02	16.40	122	40.67	1.	2.	26.	58.0
1.02	17.00	123	41.00	1.	2.	26.	58.0
1.02	17.20	124	41.33	1.	2.	26.	58.0
1.02	17.40	125	41.67	1.	2.	26.	58.0
1.02	18.00	126	42.00	1.	2.	26.	58.0
1.02	18.20	127	42.33	1.	2.	26.	58.0
1.02	18.40	128	42.67	1.	1.	26.	58.0
1.02	19.00	129	43.00	1.	1.	26.	58.0
1.02	19.20	130	43.33	1.	1.	26.	58.0
1.02	19.40	131	43.67	1.	1.	26.	58.0
1.02	20.00	132	44.00	1.	1.	26.	58.0
1.02	20.20	133	44.33	1.	1.	26.	58.0
1.02	20.40	134	44.67	0.	1.	26.	58.0
1.02	21.00	135	45.00	0.	1.	26.	58.0
1.02	21.20	136	45.33	0.	1.	26.	58.0
1.02	21.40	137	45.67	0.	1.	26.	58.0
1.02	22.00	138	46.00	0.	1.	26.	58.0
1.02	22.20	139	46.33	0.	1.	26.	58.0
1.02	22.40	140	46.67	0.	1.	26.	58.0
1.02	23.00	141	47.00	0.	1.	26.	58.0
1.02	23.20	142	47.33	0.	1.	26.	59.0
1.02	23.40	143	47.67	0.	0.	26.	58.0
1.03	0.00	144	48.00	0.	0.	26.	58.0
1.03	.20	145	48.33	0.	0.	26.	58.0
1.03	.40	146	48.67	0.	0.	25.	58.0
1.03	1.00	147	49.00	0.	0.	25.	58.0
1.03	1.20	148	49.33	0.	0.	25.	58.0
1.03	1.40	149	49.67	0.	0.	25.	58.0
1.03	2.00	150	50.00	0.	0.	25.	58.0

PEAK OUTFLOW IS 1314. AT TIME 17.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1314.	518.	167.	82.	12244.
CMS	37.	15.	5.	2.	347.
INCHES		4.02	5.16	5.27	5.27
MM		102.01	131.18	133.93	133.93
AC-FT		257.	330.	337.	337.
THOUS CU M		317.	407.	416.	416.

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SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	58.30	58.30	59.80
STORAGE	29.	29.	64.
OUTFLOW	20.	20.	113.

PAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
60.59	.79	94.	1314.	5.33	17.00	0.00

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, D.C., 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 10, Middlesex County, Rutgers University, New Brunswick, N.J., 1953.

4. "Geologic Map of New Jersey," prepared by J. Volney Lewis and Henry B. Kummel, dated 1910 - 1912.

5. Chow, Ven Te., Ed., Handbook of Applied Hydrology, McGraw-hill Book Company, 1964.

6. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.

7. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.

8. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw-Hill Book Company, 1963.